PHASE 2

Washington State
School Seismic Safety Assessments Project

CAMELOT ELEMENTARY SCHOOL MAIN BUILDING

Federal Way Public Schools

SEISMIC UPGRADES CONCEPT DESIGN REPORT

June 2021

PREPARED FOR

PREPARED BY

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WASHINGTON STATE SCHOOL SEISMIC SAFETY ASSESSMENTS PROJECT

SEISMIC UPGRADES CONCEPT DESIGN REPORT

Camelot Elementary School – Main Building

Federal Way Public Schools

June 2021

Prepared for:

State of Washington
Department of Natural Resources and Office of Superintendent of Public Instruction

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EXECUTIVE SUMMARY

This report documents the findings of a seismic evaluation of Camelot Elementary School located in the Lakeland North community in Auburn, Washington. This school building is a single story and consists of three rectangular buildings interconnected through narrow breezeways. The total area of the school is approximately 41,000 square feet. Building R, which is the multipurpose building with a covered play area, is at the east end of the campus and is approximately 80 feet by 90 feet. Buildings A & B, which are the classroom buildings in the middle and west end of the campus, are approximately 72 feet by 187 feet each and have nearly identical footprints. The buildings were originally constructed in 1964 and were designed per the Uniform Building Code (UBC) 1961 edition. The buildings were renovated in 1988. Roof construction for all buildings is wood frames with structural plywood panels supported over open-web wood trusses. The open-web wood trusses are supported on a combination of wood beams and wood-framed stud walls that bear on continuous concrete footings. Lateral forces are transferred through structural plywood diaphragms to the exterior and interior plywood-sheathed shear walls. The exterior stud walls have a relatively thick stucco pea-gravel finish that adds significant seismic weight to the wood-framed structures.

WSP USA and Reid Middleton, Inc., performed a Tier 1 screening in accordance with the ASCE 41-17 standard *Seismic Evaluation and Retrofit of Existing Buildings*. The evaluation included field observations and review of record drawings to verify the existing construction. The structural seismic evaluation indicated that the buildings have multiple seismic deficiencies; the most susceptible ones being existing shear walls that do not have enough capacity to sustain induced lateral forces, un-blocked diaphragms exceeding 40-foot spans, and lack of shear wall overturning restraint (holdowns).

Conceptual seismic upgrade recommendations for the structural systems are provided to improve the performance of the building to meet the Life Safety structural performance objective criteria of ASCE 41-17. Sketches for the concept-level seismic upgrades are provided in Appendix B.

The structural upgrades include adding new footings at the ends of shear walls, adding sill plate bolting at the shear walls, adding holdowns at the ends of shear walls, strengthening existing wood shear walls, adding straps at the re-entrant corners, and providing blocked diaphragms. Also, reducing the seismic weight by removing the heavy stucco pea-gravel finishes at the exterior walls should be considered to reduce the seismic demands on the roof diaphragms and shear walls.

The recommendations for nonstructural upgrades are to further investigate the integrated ceiling system and lighting fixtures in the main corridor to mitigate the risk of obstructions impeding the paths of egress as students and faculty evacuate the building following a seismic event.

An opinion of probable construction costs is provided in Appendix C. It is our opinion that the total cost (construction costs plus soft costs) to upgrade the structure would range between \$5.52M and \$10.3M with the baseline estimated total cost being \$6.9M.

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Acronyms

AACE	Association for the Advancement of Cost Engineering
ADA	Americans with Disabilities Act
ASCE	American Society of Civil Engineers
A-E	Architect-Engineer
BPOE	Basic Performance Objective for Existing Buildings
BSE	Basic Safety Earthquake
CMU	Concrete Masonry Unit
CP	Collapse Prevention
DNR	Department of Natural Resources
DCR	Demand-to-Capacity Ratio
EERI	Earthquake Engineering Research Institute
EPAT	EERI Earthquake Performance Assessment Tool
FEMA	Federal Emergency Management Agency
GC/CM	General Contractor / Construction Manager
GWB	Gypsum Wallboard
IBC	International Building Code
ICOS	Information and Condition of Schools
IEBC	International Existing Building Code
IO	Immediate Occupancy
LS	Life Safety
MCE	Maximum Considered Earthquake
MEP	Mechanical/Electrical/Plumbing
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
OSPI	Office of Superintendent of Public Instruction
PBEE	Performance-Based Earthquake Engineering
PR	Position Retention
ROM	Rough Order-of-Magnitude
SSSSC	School Seismic Safety Steering Committee
UBC	Uniform Building Code
URM	Unreinforced Masonry
USGS	United States Geological Survey
WF	Wide Flange
WGS	Washington Geological Survey
WSSSSAP	Washington State School Seismic Safety Assessments Project

Reference List

Codes and References

2018 IBC, *2018 International Building Code,* prepared by the International Code Council, Washington, D.C.

AACE International Recommended Practice No. 56R-08, 2020, *Cost Estimate Classification System*, prepared by the Association for the Advancement of Cost Engineering International, Fairmont, West Virginia.

ASCE 7-16, 2017, *Minimum Design Loads for Buildings and Other Structures*, prepared by the Structural Engineering Institute of the American Society of Civil Engineers, Reston, Virginia.

ASCE 41-17, 2017, *Seismic Evaluation and Retrofit of Existing Buildings*, prepared by the Structural Engineering Institute of the American Society of Civil Engineers, Reston, Virginia.

FEMA E-74, 2011, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide*, prepared by Applied Technology Council, Redwood City, California.

Structural Engineers of Northern California, 2017, Earthquake Performance Rating System ASCE 41-13 Translation Procedure: The Buildings Ratings Committee, a sub-committee of the Existing Buildings Committee of The Structural Engineers Association of Northern California.

Structural Engineers of Northern California, 2015, Earthquake Performance Rating System User's Guide: The Buildings Ratings Committee, a sub-committee of the Existing Buildings Committee of The Structural Engineers Association of Northern California.

Drawings

Harris & Reed Architects, December 31, 1963, existing architectural & structural drawings titled "Camelot Elementary School"

Harris, Reed & Litzenberger Architects, February 27, 1975, existing drawings titled "An Addition to Camelot Elementary School"

Gross, Thurman & DeMers, Inc., May 26, 1988, existing architectural & structural drawings titled "Camelot Elementary Modernization Federal Way School District No. 210"

1.0 Introduction

1.1 Background

In 2018-2019, the Washington Geological Survey (WGS), a division of the Department of Natural Resources (DNR), led a Washington State School Seismic Safety Assessments Project (WSSSSAP) that seismically and geologically screened 222 school buildings and 5 fire stations across Washington State to better understand the current level of seismic risk of Washington State's public-school buildings. This first phase of the WSSSSAP was executed with the help of Washington State's Office of Superintendent of Public Instruction (OSPI) and Reid Middleton, along with their team of structural engineers, architects, and cost estimators.

Building upon the success of Phase 1, WGS, OSPI, and Reid Middleton's team embarked on Phase 2 of this project to seismically and geologically screen another 339 school buildings and 2 fire stations, mostly located in the high-seismic risk regions of Washington State. Similar to Phase 1, the two main components of Phase 2 of this seismic safety assessments project are: (1) geologic site characterization, and (2) the seismic assessment of buildings. As a part of the seismic assessments, Tier 1 screening of structural systems and nonstructural assessments were performed in accordance with the American Society of Civil Engineers' (ASCE) Standard 41-17 *Seismic Evaluation and Retrofit of Existing Buildings*. Concept-level seismic upgrades were developed to address the identified deficiencies of a select number of school buildings to evaluate seismic upgrade strategies, feasibilities, and implementation costs.

Seventeen school buildings were selected in consultation with WGS and OSPI to receive concept-level seismic upgrade designs utilizing the ASCE 41 Tier 1 evaluation results. This report documents the concept-level seismic upgrade design for one of those school buildings. The concept-level seismic upgrades will include structural and nonstructural seismic upgrade recommendations, with concept-level sketches and rough order-of-magnitude (ROM) construction costs determined for each building. The 17 school buildings were selected from the list of schools with the intent of representing a variety of regions, building uses, construction eras, and construction materials.

The overall goal of the project is to provide a better understanding of the current seismic risk of our state's K-12 school buildings and what needs to be done to improve the buildings in accordance with ASCE 41 to meet seismic performance objectives.

The seismic evaluation consists of a Tier 1 screening for the structural systems performed in accordance with ASCE 41-17.

1.2 Scope of Services

The project is being performed in several distinct and overlapping phases of work. The scope of this report is as listed in the following sections.

1.2.1 Information Review

1. Project Research: Reid Middleton and their project team researched available school building records, such as relevant site data and record drawings, in advance of the field investigations. This research included searching school building records and contacting the districts and/or the Office of Superintendent of Public Instruction (OSPI) to obtain building plans, seismic reports, condition reports, or related construction information useful for the project.

2. Site Geologic Data: Site geological data provided by the WGS, including site shear wave velocities, was utilized to determine the project Site Class in accordance with ASCE 41, which is included in the Tier 1 checklists and concept-level seismic upgrades design work.

1.2.2 Field Investigations

1. Field Investigations: Each of the identified buildings was visited to observe the building's age, condition, configuration, and structural systems for the purposes of the ASCE 41 Tier 1 seismic evaluations. This task included confirmation of general information in building records or layout drawings and visual observation of the structural condition of the facilities. Engineer field reports, notes, photographs, and videos of the facilities were prepared and utilized to record and document information gathered in the field investigation work.

2. Limitations Due to Access: Field observation efforts were limited to areas and building elements that were readily observable and safely accessible. Observations requiring access to confined spaces, potential hazardous material exposure, access by unsecured ladder, work around energized equipment or mechanical hazards, access to areas requiring Occupational Safety and Health Administration (OSHA) fall-protection, steep or unstable slopes, deteriorated structural assemblies, or other conditions deemed potentially unsafe by the engineer were not performed. Removal of finishes (e.g., gypsum board, lath and plaster, brick veneer, roofing materials) for access to concealed conditions or to expose elements that could not otherwise be visually observed and assessed was not performed. Material testing or sampling was not performed. The ASCE 41 checklist items that were not documented due to access limitations are noted.

1.2.3 Seismic Evaluations and Conceptual Upgrades Design

1. Seismic Evaluations: Limited seismic assessments of the structural and nonstructural systems of the school buildings were performed in accordance with ASCE 41-17 Tier 1 Evaluation Procedures.

2. Conceptual Upgrades Design: Further seismic evaluation work was performed to provide concept-level seismic retrofits and/or upgrade designs for the selected school buildings based on the results of the Tier 1 seismic evaluations. The concept-level seismic upgrades design work included narrative descriptions of proposed seismic retrofits and/or

upgrade schemes and concept sketches depicting the extent and type of recommended structural upgrades.

3. Architectural Review: The seismic upgrade concept developed by the structural engineers was reviewed by Rolluda Architects, Inc., for general guidance and consideration of the architectural aspects of the seismic upgrade. The architects discussed the seismic upgrade concepts with the structural engineer and reviewed existing drawings that were available, pictures taken during the engineer's field investigations, and the ASCE 41 Tier 1 Screening reports. However, field visits by the architect and meetings with the school district and facilities personnel to discuss phasing and programming requirements were not included in the project scope of work. The architectural considerations are discussed in Section 4.4 Nonstructural Recommendations and Considerations. These conceptual designs were reviewed with high-level recommendations. Future planning for seismic improvements should include further review with a design team.

4. Cost Estimating: Through the concept-level seismic upgrades report process, ProDims, LLC, provided opinions of probable construction costs for the concept-level seismic upgrade designs for the selected school buildings. These concept-level seismic upgrade designs and the associated opinions of probable construction costs are intended to be representative samples that can be extrapolated to estimate the overall capital needs of seismically upgrading Washington State schools.

1.2.4 Reporting and Documentation

1. Conceptual Upgrade Design Reports: Buildings that were selected to receive a conceptual upgrade design will have a report prepared that will include an introduction summarizing the overall findings and recommendations, along with individual sections documenting each building's seismic evaluation, list of deficiencies, conceptual seismic upgrade sketches and opinions of probable construction costs.

2. Building Photography: Photos were taken of each building during on-site walkthroughs to document the existing building configurations, conditions, and structural systems. These are available upon request through DNR/WGS.

3. Existing Drawings: Select and available existing drawings and other information were collected during the evaluation process. These are available upon request through DNR/WGS.

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2.0 Seismic Evaluation Procedures and Criteria

2.1 ASCE 41 Seismic Evaluation and Retrofit Overview

The current standard for seismic evaluation and retrofit (upgrades) of existing buildings is ASCE 41-17. ASCE 41 provides screening and evaluation procedures used to identify potential seismic deficiencies that may require further investigation or hazard mitigation. It presents a three-tiered review process, implemented by first following a series of predefined checklists and "quick check" structural calculations. Each successive tier is designed to perform an increasingly refined evaluation procedure for seismic deficiencies identified in previous tiers in the process. The flow chart in Figure 2.1 illustrates the evaluation process.

TIER 1 – Screening Phase

- Checklists of evaluation statements to quickly identify potential deficiencies
- Requires field investigation and/or review of record drawings
- Analysis limited to "Quick Checks" of global elements
- May proceed to Tier 2, Tier 3, or rehabilitation design if deficiencies are identified

TIER 2 – Evaluation Phase

- "Full Building" or "Deficiency Only" evaluation
- Address all Tier 1 seismic deficiencies
- Analysis more refined than Tier 1, but limited to simplified linear procedures
- Identify buildings not requiring rehabilitation

TIER 3 – Detailed Evaluation Phase

- Component-based evaluation of entire building using reduced ASCE 41 forces
- Advanced analytical procedures available if Tier 1 and/or Tier 2 evaluations are judged to be overly conservative
- Complex analysis procedures may result in construction savings equal to many times their cost

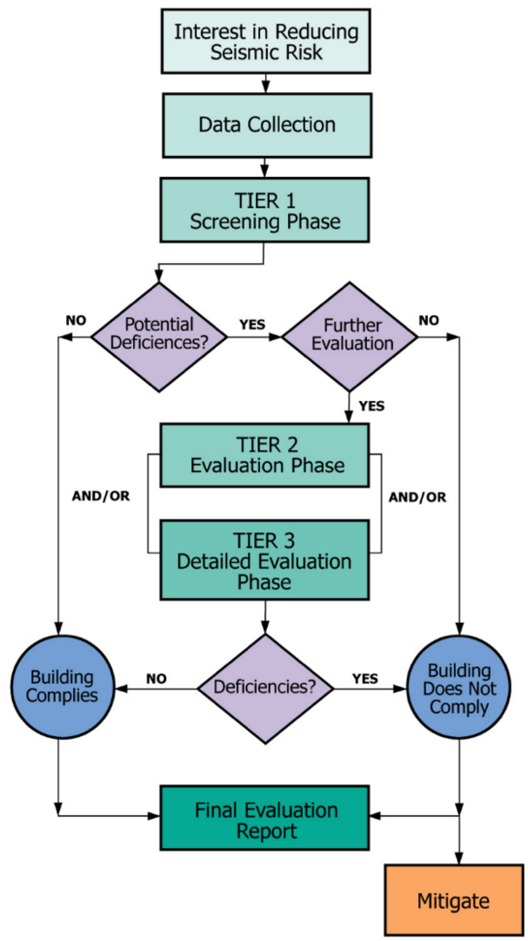

Figure 2-1. Flow Chart and Description of ASCE 41 Seismic Evaluation Procedure.

The Tier 1 checklists in ASCE 41 are specific to each common building type and contain seismic evaluation statements based on observed structural damage in past earthquakes. These checklists screen for potential seismic deficiencies by examining the lateral-force-resisting systems and details of construction that have historically caused poor seismic performance in similar buildings. Tier 1 screenings include basic "Quick Check" analyses for primary components of the lateral system. Tier 1 screenings also include prescriptive checks for proper seismic detailing of connections, diaphragm spans and continuity, and overall system configuration.

Tier 2 evaluations then follow with more-detailed structural and seismic calculations and assessments to either confirm the potential deficiencies identified in the Tier 1 review or demonstrate their adequacy. A Tier 3 evaluation involves an even more detailed analysis and advanced structural and seismic computations to review each structural component's seismic demand and capacity. A Tier 3 evaluation is similar in scope and complexity to the types of analyses often required to design a new building in accordance with the International Building Code (IBC), with a comprehensive analysis aimed at evaluating each component's seismic performance. Generally, Tier 3 evaluations are not practical for typical and regular-type buildings due to the rigorous and complicated calculations and procedures. As indicated in the Scope of Services, this evaluation included a Tier 1 screening of the structural systems.

2.2 Seismic Evaluation and Retrofit Criteria

Performance-Based Earthquake Engineering (PBEE) can be defined as the engineering of a structure to resist different levels of earthquake demand in order to meet the needs and performance objectives of building owners and other stakeholders. ASCE 41 employs a PBEE design methodology that allows building owners, design professionals, and the local building code authorities to establish seismic hazard levels and performance goals for individual buildings.

2.2.1 Site Class Definition

The building site class definition quantifies the site soil's propensity to amplify or attenuate earthquake ground motion propagating from underlying rock. Site class has a direct impact on the seismic design forces utilized to design and evaluate a structure. There are six distinct site classes defined in ASCE 7-16, Site Class A through Site Class F, that range from hard rock to soils that fail such as liquefiable soils. Buildings located on soft or loose soils will typically sustain more damage than similar buildings located on stiff soils or rock, all other things being equal. The Washington State Department of Natural Resources measured the time-averaged shear-wave velocity at each site to 30 meters (100 feet) below the ground surface, Vs30. This measured shear-wave velocity was used to determine the site class. The site class for this building was determined to be **Site Class C**.

2.2.2 Camelot Elementary School Seismicity

Seismic hazards for the United States have been quantified by the United States Geological Survey (USGS). The information has been used to create seismic hazard maps, which are currently used in building codes to determine the design-level earthquake magnitudes for building design.

The Level of Seismicity is categorized as Very Low, Low, Moderate, or High based on the probabilistic ground accelerations. Ground accelerations and mass generate inertial (seismic) forces within a building (Force = mass x acceleration). Ground acceleration therefore is the parameter that classifies the level of seismicity. From geographic region to region, as the ground accelerations increase, so does the level of seismicity (from low to high). Where this building is located, the design short-period spectral acceleration, S_{DS}, is 0.799 g, and the design 1-second period spectral acceleration, S_{D1}, is 0.462 g. Based on ASCE 41 Table 2-4, the Level of Seismicity for this building is classified as **High**.

The ASCE 41 Basic Performance Objective for Existing Buildings (BPOE) makes use of the Basic Safety Earthquake – 1E (BSE-1E) seismic hazard level and the Basic Safety Earthquake – 2E (BSE-2E). The BSE-1E earthquake is defined by ASCE 41 as the probabilistic ground motion with a 20 percent probability of exceedance in 50 years, or otherwise characterized as a ground motion acceleration with a probabilistic 225-year return period. The BSE-2E earthquake is defined by ASCE 41 as the probabilistic ground motion with a 5 percent probability of exceedance in 50 years, or otherwise characterized as a ground motion acceleration with a probabilistic 975-year return period. The BSE-2N seismic hazard level is the Maximum Considered Earthquake (MCE) ground motion used in current codes for the design of new buildings and is also used in ASCE 41 to classify the Level of Seismicity for a building. The BSE-2N has a statistical ground motion acceleration with 2 percent probability of exceedance in 50 years, or otherwise characterized as a ground motion acceleration with a probabilistic 2,475-year return period.

Table 2.2.1-1 provides the spectral accelerations for the 225-year, 975-year, and 2,475-year return interval events specific to Camelot Elementary School that are considered in this study.

Table 2.2.1-1. Spectral Acceleration Parameters (Site Class C).

BSE-1E 20%/50 (225-year) Event		BSE-1N 2/3 of 2,475-year Event		BSE-2E 5%/50 (975-year) Event		BSE-2N 2%/50 (2,475-year) Event	
0.2 Seconds	0.645 g	0.2 Seconds	0.799 g	0.2 Seconds	1.213 g	0.2 Seconds	1.584 g
1.0 Seconds	0.2289 g	1.0 Seconds	0.462 g	1.0 Seconds	0.511 g	1.0 Seconds	0.679 g

2.2.3 Camelot Elementary School Structural Performance Objective

The school building is an Educational Group E occupancy (Risk Category III) structure and has not been identified as a critical structure requiring immediate use following an earthquake. However, Risk Category III buildings are structures that represent a substantial hazard to human life in the event of failure. According to ASCE 41, the BPOE for Risk Category III structures is the Damage Control structural performance level at the BSE-1E seismic hazard level and the Limited Safety structural performance level at the BSE-2E seismic hazard level. The ASCE 41 Tier 1 evaluations were conducted in accordance with ASCE 41 requirements and ASCE 41 seismic performance levels. Concept-level upgrades were developed for the **Life Safety** structural performance level at the **BSE-1N** seismic hazard level in accordance with DNR direction, the project scope of work, and the project legislative language.

At the Life-Safety performance level, the building may sustain damage while still protecting occupants from life-threatening injuries and allowing occupants to exit the building. Structural and nonstructural components may be extensively damaged, but some margin against the onset of partial or total collapse remains. Injuries to occupants or persons in the immediate vicinity may occur during an earthquake; however, the overall risk of life-threatening injury as a result of structural damage is anticipated to be low. Repairs may be required before reoccupying the building, and, in some cases, repairs may be economically unfeasible.

Knowledge Factor

A knowledge factor, *k*, is an ASCE 41 prescribed factor that is used to account for uncertainty in the as-built data considering the selected Performance Objective and data collection processes (availability of existing drawings, visual observation, and level of materials testing). No in-situ testing of building materials was performed; however, some material properties and existing construction information were provided in the existing record drawings. If the concept design is developed further, additional materials tests and site investigations will be required to substantiate assumptions about the existing framing systems.

ASCE 41 Classified Building Type

Use of ASCE 41 for seismic evaluations requires buildings to be classified from a group of common building types historically defined in previous seismic evaluation standards (ATC-14, FEMA 310, and ASCE 31-03). The school is classified in ASCE 41 Table 3-1 as a light-framed wood shear wall building with flexible diaphragms, **W2**. Wood shear wall buildings (W2) include those that have bearing shear walls constructed of wood framed stud walls with elevated floor and roof framing structural systems consisting of wood framing.

2.3 Report Limitations

The professional services described in this report were performed based on available record drawing information and limited visual observation of the structure. No other warranty is made as to the professional advice included in this report. This report provides an overview of the seismic evaluation results and does not address programming and planning issues. This report has been prepared for the exclusive use of DNR/WGS and is not intended for use by other parties, as it may not contain sufficient information for purposes of other parties or their uses.

3.0 Building Description & Seismic Evaluation Findings

3.1 Building Overview

3.1.1 Building Description

Original Year Built: 1964
Building Code: 1961 UBC

Number of Stories: 1
Floor Area: 41,111 SF

FEMA Building Type: W2
ASCE 41 Level of Seismicity: High
Site Class: C

Camelot Elementary School is composed of three one-story wood shear wall structures with stucco pea-gravel facades. The buildings were originally constructed in 1964 and were renovated in 1988. The buildings are all roughly rectangular in plan. Building R is the multipurpose room and measures 90 feet by 81 feet. Buildings A and B are classroom buildings that have nearly identical footprints that measure 187 feet by 72 feet. The buildings have mono-slope roofs; the Building R roof has an average height of 22.5 feet, and the Buildings B and C roofs have an average height of 12.5 feet. The building roofs are interconnected with a series of breezeway roof segments.

3.1.2 Building Use

Building R is the multipurpose building with a gymnasium and kitchen. Buildings B and C have classroom, library, and administrative spaces.

3.1.3 Structural System

Table 3.1.3-1. Structural System Descriptions.

Structural System	Description
Structural Roof	The roof is wood framed with wood structural panels over open-web trusses (Trus-Joists) spanning to wood stud bearing walls and glulam beams.
Structural Floor(s)	Unreinforced 5-inch slab on grade (per existing drawings).
Foundations	The foundations are traditional shallow foundations: concrete strip footings at exterior wall lines, with slab on grade at the interior.
Gravity System	The primary gravity system is a combination of wood stud bearing walls and beam systems. Roof loads are supported by sheathing and open-web

Table 3.1.3-1. Structural System Descriptions.

Structural System	Description
	wood trusses that span to roof beams and bearing walls supported by conventional spread footings.
Lateral System	Lateral forces are resisted by plywood-sheathed roof diaphragms that transfers loads to plywood-sheathed shear walls at the exterior and interior of the buildings. These shear walls transfer the lateral loads (seismic/wind) directly to the foundations.

3.1.4 Structural System Visual Condition

Table 3.1.4-1. Structural System Condition Descriptions.

Structural System	Description
Structural Roof	No visible signs of damage or deterioration.
Structural Floor(s)	Not applicable.
Foundations	No visible signs of damage or deterioration.
Gravity System	No visible signs of damage or deterioration.
Lateral System	No visible signs of damage or deterioration.

3.2 Seismic Evaluation Findings

3.2.1 Structural Seismic Deficiencies

The structural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is provided based on this evaluation.

Table 3.2.1-1. Identified Structural Seismic Deficiencies Based on Tier 1 Checklists.

Deficiency	Description
Shear Stress Check	It appears that both interior and exterior walls are used as shear walls; however, there still appear to be locations that are overstressed. There is a layer of heavy, aggregate-embedded, cementitious finish on many of the walls that drastically increases the seismic weight of the buildings and overstresses the shear walls.
Diagonally Sheathed and Unblocked Diaphragms	The drawings indicate that only the ends of the classroom buildings (Buildings B and C) are blocked, approximately 8% of the diaphragm at each end. It is assumed the remaining 84% of the diaphragms in between are not blocked and exceed 40 feet in some locations. Further investigation is required, and diaphragm strengthening may be needed to mitigate seismic risk.

3.2.2 Structural Checklist Items Marked as “U”nknown

Where building structural component seismic adequacy was unknown due to lack of available information or limited observation, the structural checklist items were marked as “unknown”. These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown structural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is provided based on the evaluation.

Table 3.2.2-1. Identified Structural Checklist Items Marked as Unknown.

Deficiency	Description
Liquefaction	The ICOS system identifies this site as having very low liquefaction potential. Further investigation by a licensed geotechnical engineer is necessary to verify liquefaction potential.
Surface Fault Rupture	There does not appear to be a record of surface faulting in this region; however, investigation by a licensed geotechnical engineer is necessary to verify the surface fault rupture potential.

3.2.3 Nonstructural Seismic Deficiencies

Table 3.2.3-1 summarizes the seismic deficiencies in the nonstructural systems. The Tier 1 screening checklists are provided in Appendix A.

Table 3.2.3-1. Identified Nonstructural Seismic Deficiencies based on Tier 1 Checklists.

Deficiency	Description
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	Tall and narrow contents that are prone to toppling during an earthquake, such as cabinets and bookshelves, should be braced or anchored to the structure.
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	Fall prone items of 20 pounds or more stored over 4 feet above the ground should be braced or restrained.

3.2.4 Nonstructural Checklist Items Marked as “U”nknown

Where building nonstructural component seismic adequacy was unknown due to lack of available information or limited observation, the nonstructural checklist items were marked as “unknown”. These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown nonstructural checklist items identified during the

Tier 1 evaluation are summarized below. Commentary for each unknown item is provided based on the evaluation.

Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

Table 3.2.4-1. Identified Nonstructural Checklist Items Marked as Unknown.

Deficiency	Description
P-3 Drift. HR-not required; LS-MH; PR-MH.	Details of the partitions with rigid cementitious finishes were not available to determine if the partitions can accommodate 2% lateral drift.
LF-1 Independent Support	The light fixtures in dropped acoustical ceilings were not observed during the field visit. Maintenance and facility staff should verify that each fixture is independently supported to the roof structure with two wires at opposite corners to prevent fixtures and live conduit from following during a seismic event.

4.0 Recommendations and Considerations

4.1 Seismic-Structural Upgrade Recommendations

Concept-level seismic upgrade recommendations to improve the lateral-force-resisting system were developed. The sketches in Appendix B depict the concept-level structural upgrade recommendations outlined in this section. The following concept recommendations are intended to address the structural deficiencies noted in Table 3.2.1-1. This concept-level seismic upgrade design represents just one of several alternative seismic upgrade design solutions and is based on preliminary seismic evaluation and analysis results. Final analysis and design for seismic upgrades must include a more detailed seismic evaluation of the building in its present or future configuration. Proposed seismic upgrades include the following.

4.1.1 Addition of Footings at End of Shear Walls to Resist Uplift

The existing foundations supporting the shear walls are not adequate to resist the shear wall overturning forces. Enlarging the foundation at the ends of shear walls is recommended to provide additional bearing capacity to better distribute overturning forces to the soil. Enlarging the footings also provides the additional dead load to resist shear wall uplift forces for overturning forces in the opposite direction. At the exterior shear wall locations this will require removing existing soil at grade and installing new footings that are epoxy doweled into the side of the existing footings. At the interior shear wall locations, adding foundation will require removing the existing slab on grade and then installing a thickened slab footing that is epoxy doweled to the existing footings. The existing roof structure may need to be temporarily shored for addition of new footings at the ends of interior shear walls.

4.1.2 Additional Sill Bolting at Wood Shear Walls

The existing wood shear wall sill bolts are connected to the concrete foundations at 48 inches on center. The existing sill bolt spacing is inadequate to transfer the in-plane shear forces in the foundations. Additional sill plate bolts are recommended. This will require removing and replacing the wall finishes partially (2 feet to 4 feet AFF approximately) at the bottom of the wall to install additional heavy duty concrete screws (such as Simpson Titen HD screws) through the existing wood sill plates and into the concrete foundation below.

4.1.3 Holdown Installation at Ends of Wood Shear Walls

The existing overturning restraint of the exterior and interior wood-framed shear walls is not adequate. New holdowns (Simpson or similar) are recommended at the ends of the shear walls to resist shear wall overturning forces. The wall finishes will need to be removed and replaced at the wall base to access the lower ends of wood studs. .

4.1.4 Strengthen Existing Wood Shear Walls and Add New Wood Shear Walls

It is recommended that the existing shear walls be strengthened in select locations, see Figure 1 in Appendix B. Furthermore, new additional shear walls are recommended at the east end of the play area. Additional panel edge nailing should be provided to strengthen the existing wood shear walls. For existing wood shear walls to receive additional nailing, wall finishes will need to be removed and replaced after the nailing is complete. The exterior wood shear wall strengthening may be achieved from the outside face of the wall or the inside face of the wall. If the walls are strengthened from the inside, new 1/2-inch plywood or oriented strand board sheathing should also be provided. Please note that there is a cement stucco with a pea-gravel finish panel that exists at the exterior of the buildings in most locations. This increases the seismic demand on the building and its shear walls. The seismic demands may be reduced by removing this heavy exterior wall finish. However, it is recommended that the shear walls be strengthened whether the stucco pea-gravel finish is removed or remains in place.

4.1.5 Blocked Wood Roof Diaphragm

The existing building structure consists of three rectangular buildings. These rectangular buildings are connected through narrow breezeway structures. The breezeway roof diaphragms are relatively less stiff than the building structures on either side. It is recommended that the breezeway roof diaphragms be strengthened for better performance in a seismic event. Similarly, the play area roof to the east of the gym is a cantilever diaphragm and should be strengthened. Blocked roof diaphragms are recommended at breezeways and over the play area. For blocked roof diaphragms at breezeways and the play area, new 2x6 joists at 24 inches on center on the underside of the existing roof structure are recommended.

4.1.6 Metal Strapping at Building Re-entrant Corners

Re-entrant corners occur where the rectangular buildings meet the breezeways. Metal strapping on top of the plywood roof sheathing is recommended at these re-entrant corners. Straps are also proposed at the play area to the east of the gym (Building R) to drag seismic forces into the wood shear walls at the gym. Metal strapping is recommended to be installed over the existing plywood sheathing by removing the existing built-up roofing; the built-up-roofing will need to be reinstalled once the straps are installed. Additional wood blocking would be required on the underside of the roof sheathing to receive the strap nailing.

4.2 Foundations and Geotechnical Considerations

A detailed geotechnical analysis of the site soils was not included in the scope of this study. As a result, the geotechnical seismic effects on the existing building and its foundations, such as the presence of liquefiable soils and allowable soil bearing pressures, are unknown at this time. However, based on state of Washington liquefaction mapping, the building is located on soils classified with a very low susceptibility to liquefaction. Future seismic upgrade projects should consider doing a geotechnical investigation to verify that the underlying soils are not susceptible to liquefaction and to determine the nature of the liquefaction hazard and the characteristics of the site soils. Foundation mitigation and ground improvement may be required and the recommended geotechnical investigation could have a major impact on the scope of work required for seismic retrofit

Liquefaction is the tendency of certain soils to saturate and lose strength during strong earthquake shaking, causing it to flow and deform similar to a liquid. Liquefaction, when it occurs, drastically decreases the soil bearing capacity and tends to lead to large differential settlement of soil across a building's footprint. Liquefaction can also cause soils to spread laterally and can dramatically affect a building's response to earthquake motions, all of which can significantly compromise the overall stability of the building and possibly lead to isolated or widespread collapse in extreme cases. Existing foundations damaged as a result of liquefiable soils also make the building much more difficult to repair after an earthquake.

Buildings that are not founded on a raft foundation or deep foundation system (such as grade beams and piles), and those with conventional strip footings and isolated spread footings that are not interconnected well with tie beams, are especially vulnerable to liquefiable soils. Mitigation techniques used to improve structures in liquefiable soils vary based on the type and amount of liquefiable soils and may include ground improvements to densify the soil (aggregate piers, compaction piling, jet grouting), installation of deep foundations (pin piling, augercast piling, micro-piling), and installation of tie beams between existing footings.

4.3 Tsunami Considerations

The building is not located in a tsunami inundation zone according to Washington State Department of Natural Resources tsunami inundation mapping. It is not necessary to consider tsunamis when planning seismic upgrades to this building.

4.4 Nonstructural Recommendations and Considerations

Table 3.2.3-1 identifies nonstructural deficiencies that do not meet the performance objective selected for Camelot Elementary School. It is recommended that these deficiencies be addressed to provide nonstructural performance consistent with the performance of the upgraded structural lateral-force-resisting system. As-built information for the existing nonstructural systems, such as fire sprinklers, mechanical ductworks, and piping, are not available for review. Only limited visual observation of the systems was performed during field investigation due to limited access or visibility to observe existing conditions. The conceptual mitigation strategies provided in this study are preliminary only. The final analysis and design for seismic rehabilitation should include a detailed field investigation.

4.4.1 Architectural Systems

This section addresses existing construction that, while not posing specific hazards during a seismic event, would be affected by the seismic improvements proposed.

For any remodel project of an existing building, the International Existing Building Code (IEBC) would be applicable. The intent of the IEBC is to provide flexibility to permit the use of alternative approaches to achieve compliance with minimum requirements to safeguard the public health, safety, and welfare insofar as they are affected by the work being done.

Energy Code

Elements of the exterior building envelope to be affected by the proposed seismic upgrade work may be required to be brought up to the current Washington State Energy Code per Chapter 5, where applicable.

Accessibility

It should also be noted that, as a part of any upgrade to existing buildings, the IEBC will require that any altered primary function spaces (classrooms, gyms, entrances, offices) and routes to these spaces, be made accessible to the current accessibility standards of the Americans with Disabilities Act (ADA), unless technically infeasible.

This would include but is not limited to accessible restrooms, paths of travel, entrances and exits, parking, signage and Life Safety alarm systems. Under no circumstances should the facility be made less accessible. The IEBC does, however, have exceptions for areas that do not contain a primary function (storage room, utility rooms) and states that costs of providing the accessible route are not required to exceed 20 percent of the costs of the alterations affecting the area of Primary Function.

As with any major renovation and modernization, an ADA study should be performed to determine the extent to which an existing facility would need to be improved in order to comply with current ADA requirements.

Hazardous Materials Survey

Given the age of the building, existing construction elements such as floor tile and/or adhesive, pipe insulation, etc., could contain asbestos. Verify that a Hazardous Materials survey and abatement of the buildings has been performed prior to the start of any demolition work. Existing plaster ceilings remain and will need to be removed in some areas – verify plaster does not contain asbestos.

Addition of Footings at Ends of Shear Walls, Sill Bolts, and Holdowns

Added foundation at the exterior of the building will require removing existing soil at grade and pouring new footings abutting the existing footings. At the interior of the building, existing slab on grade will have to be removed and then poured back after new footings are poured. New footings at existing and new shear walls will require removal of the flooring materials at least three feet out from the walls in order to construct the new foundations. The flooring appears to be vinyl composition tiles and, given the age of the building, the tile and/or adhesive could contain asbestos. An asbestos survey of the building is recommended prior to any demolition. The existing roof structure may have to be shored for addition of new footings at the end of interior shear walls.

Addition of Sill Bolts, Holdowns at Existing and New Shear Walls

Existing wall finishes will need to be removed partially (2 feet to 4 feet approximately) along the bottom of the wall to drill holes in the existing concrete footings through the existing wood sill plates. The wall finishes will have to be replaced once all new sill bolts are installed. Where drywall is replaced, work will include painting of the entire wall and installation of new rubber base.

Existing electrical outlets, switches, and other items will need to be reinstalled. Paint and new rubber base should be installed to match adjacent wall finishes.

Moisture barriers and batt insulation in exterior walls will need to be restored and may be required to meet current energy code requirements.

Replacement of Heavy Finishes at Existing Exterior Shear Walls

Replacing existing cement stucco pea-gravel finishes on exterior walls may reduce foundation and holdown sizes. The replacement exterior wall finish would ideally match the look of existing finish, while reducing weight and adding shear strength. Suggested finishes include exterior wall cladding that utilizes rigid insulation boards on the exterior of the wall sheathing, with a plaster appearance exterior skin.

Anchorage and Bracing to Roof Diaphragm

Access to the roof structure to install wall anchorage will require the removal and reinstallation of exterior soffit boards with acrylic finish.

Ceilings in all the classrooms will need to be removed along the exterior walls and interior corridor walls. Theses ceilings are glued or stapled acoustic tile over plaster ceilings anchored to the bottom chord of the roof trusses with attic insulation on top. Due to the age and condition of the existing ceiling tiles, replacement of all ceiling tiles in the classrooms is recommended.

Blocked Wood Roof Diaphragm

Blocked diaphragms are proposed at breezeways and over the play area. For blocked diaphragm at breezeways and the play area, new 2x6 joists at 24 inches on center on the underside of the existing roof structure is recommended. Work may include removal of existing plaster ceilings beneath acoustical ceiling tile; ensure asbestos is not present before start of demolition. Replace with exterior-grade soffit board and acrylic finish.

The drawings show batt insulation laid above the interior ceiling surfaces between trusses and beams, possibly creating an unconditioned attic space above. Installing above-roof continuous rigid insulation of R-38 over the entire roof to comply with current energy code is recommended. Any mechanical equipment curbs should be raised to accommodate the thicker insulation. Alternately, additional batt insulation above the ceilings at the bottom of the trusses would need to be added to increase the existing R-13 insulation to an R-49.

Ceiling in Paths of Egress

The suspended ceiling in the main corridor is an integrated acoustical ceiling system, likely with a suspended metal T-grid. Because this corridor is a main path of egress, it is recommended that the ceiling grid support system be further investigated and checked for proper seismic bracing and compression support for every 12 square feet of area and proper edge clearance detailing at the corridor walls. Preventing the risk of a fallen integrated ceiling system will mitigate the risk of obstructions impeding the paths of egress as students and faculty evacuate the building following a seismic event.

Lighting Fixtures in Paths of Egress

The light fixtures observed in the main corridor are supported within an integrated ceiling system that is over a main path of egress. Maintenance and facility staff should verify that each fixture is independently supported to the roof structure from opposite corners and add wire supports as necessary.

Contents and Furnishings

Buildings often contain various tall and narrow furniture, such as shelving and storage units, that are freestanding away from any backing walls. High book shelving in the library, for example, can be highly susceptible to toppling if not anchored properly to the backing walls or to each other, and can become a life safety hazard. It is recommended that maintenance and facility staff verify that the tops of the shelving units are braced or anchored to the nearest backing wall or provide overturning base restraint. Heavy items weighing more than 20 pounds on upper shelves or cabinet furniture should also be restrained by netting or cabling to avoid becoming falling hazards to students or faculty below.

4.4.2 Mechanical Systems

The main seismic concerns for mechanical equipment are sliding, swinging, and overturning. Inadequate lateral restraint or anchorage can shift equipment off its supports, topple equipment to the ground, or dislodge overhead equipment, making them falling hazards. Investigation of above-ceiling mechanical equipment and systems was not part of this study, but an initial investigation for the presence of mechanical equipment bracing can be performed by maintenance and facility staff to see if equipment weighing more than 20 pounds with a center of mass more than 4 feet above the adjacent floor level is laterally braced. If bracing is not present, and the equipment poses a falling hazard to students and faculty below, further investigation is recommended by a structural engineer.

4.5 Opinion of Probable Conceptual Seismic Upgrades Costs

An opinion of probable project costs of the concept-level seismic upgrade recommendations provided in this report is included in Appendix C. The input of the scope of work to develop the probable costs is the Tier 1 checklists and the preliminary concept-level seismic upgrades design recommendations and sketches. These preliminary concept-level design sketches depict a design concept that could be implemented to improve the seismic safety of the building structure. It is important to note the preliminary seismic upgrades design concept is based on the results of the Tier 1 seismic screening checklists and engineering design judgement and has not been substantiated by detailed structural analyses and calculations.

For this preliminary opinion of probable costs, the estimate of construction costs of the preliminary scope of work is developed based on current 1st Quarter (1Q) 2021 costs. Costs are then escalated to 4Q 2022 at 6% per year of the baseline cost estimate. Costs are developed based on the Tier 1 checklist, concept-level seismic upgrade design sketches, and project narratives.

A range of the cost estimate of -20% (low) to +50% (high) is used to develop the range of the construction cost estimate for the concept-level scope of work. The -20% to +50% range guidance is from Table 1 of the AACE International Recommended Practice 56R-08, *Cost Estimate Classification System*. This estimate is classified as a Class 5 based on the level of design of 0% to 2%. The range of a Class 5 construction cost estimate based on the AACE guidance selected for this estimate is a -20% to +50%.

The estimated total cost (construction costs plus soft costs) to mitigate the deficiencies identified in the Tier 1 checklists of the Camelot Elementary School Main Building ranges between approximately $5.52M and $10.3M (-20%/+50%). The baseline estimated total cost to seismically upgrade this building is approximately $6.88M. On a per-square-foot basis, the baseline seismic upgrade cost is estimated to be approximately $168 per square foot in 4Q 2022 dollars, with a range between $134 per square foot and $252 per square foot.

4.5.1 Opinion of Probable Construction Costs

This conceptual opinion of construction cost includes labor, materials, equipment, and scope contingency, general contractor general conditions, home office overhead, and profit. This is based on a public sector design-bid-build project delivery method. Project delivery methods such as negotiated, state of Washington GC/CM, and design-build are not the basis of the construction costs. Owner's Soft Costs are described below in section 4.5.2.

The cost is developed in 1Q 2021 costs. The costs are then escalated to 4Q 2022 using an escalation rate of 6.0% per year. If the mid-point of construction will occur at a date earlier or later than 4Q 2022, then it is appropriate to adjust the escalation to the revised mid-point of construction. Construction Costs excluded from the estimate are site work, phasing of construction, additional building modifications not directly related to the seismic scope of work, off hours labor costs, accelerated schedule overtime labor costs, replacement/relocation/additional FF+E, and building code changes that occur after this report.

For project budget planning purposes, it is highly recommended that the opinion of probable project costs is determined including: the overall construction budget of the seismic upgrade and additional scope of work for the building via the services of an A/E design team to study the proposed seismic mitigation strategies to refine the concept-level seismic upgrades design approach contained in this report, determine the construction timeline to adjust the escalation costs, define the construction phasing, if any, and the project soft costs.

4.5.2 Opinion of Probable A-E Design Budgets and Owner's Additional Project Costs (Soft Costs)

Additional owner's project costs would likely include owner's project administration costs, including project management, financing/bond costs, administration/contract/accounting costs, review of plans, value engineering studies, building permits, bidding costs, equipment, fixtures, furnishings and technology, and relocation of the school staff and students during construction. These costs are known as soft costs.

These soft costs have been included in the opinion of probable costs at 40% of the baseline probable construction cost for the seismic upgrade of this building.
The soft costs used for the projects that total to 40% are:
A+E Design - 10%
QA/QC Testing - 2%
Project Administration - 2%
Owner Contingency - 11%
Average Washington State Sales Tax - 9%
Building Permits - 6%

It is typical for soft costs to vary from owner to owner. Based upon our team members' experience on K-12 school projects in the state of Washington, it is our opinion that an allowance of 40% of the average probable construction cost is a reasonable and appropriate soft cost recommendation for planning purposes. We also recommend that each owner develop their own soft costs as part of their budgeting process and not rely solely on this recommended percentage.

4.5.3 Opinion of Escalation Rates

A 6.0%/year construction cost escalation rate is used for planning purposes for the conceptual estimates. The rate is compounded annually to the projected midpoint of construction. This rate is representative of the escalation based on the previous five years of market experience of construction costs throughout the state of Washington and is projected going forward for these projects. This rate is calculated to the 4th Quarter of 2022 as an allowance for planning purposes. The actual construction schedule for the project is to be determined and we recommend the escalation cost be revised based on revised construction schedule using the 6%/year rate.

Table 4.5.3-1. Seismic Upgrades Opinion of Probable Construction Costs.

Building	FEMA Bldg Type	ASCE 41 Level of Seismicity / Site Class	Structural Performance Objective	Bldg Gross Area	Estimated Seismic Upgrade Cost Range $/SF (Total)	Estimated Seismic Upgrade Cost/SF (Total)
Camelot Elementary School Main Bldg.	W2	High / C	**Structural**			
			Life Safety	41,111 SF	$64 - $120 ($2.62M) ($4.91M)	$80 ($3.28M)
			Nonstructural			
			Life Safety	41,111 SF	$32 - $60 ($1.31M) ($2.46M)	$40 ($1.64M)
			Total			
				41,111 SF	$96 - $180 ($3.93M) ($7.37M)	$120 ($4.92M)
					Estimated Soft Costs:	$1.97M
					Total Estimated Project Costs:	**$6.88M**

W: Wood-Framed; URM: Unreinforced Masonry; RM: Reinforced Masonry; C: Reinforced Concrete; PC: Precast concrete; S: Steel-framed

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Appendix A: Field Investigation Report and Tier 1 Checklists

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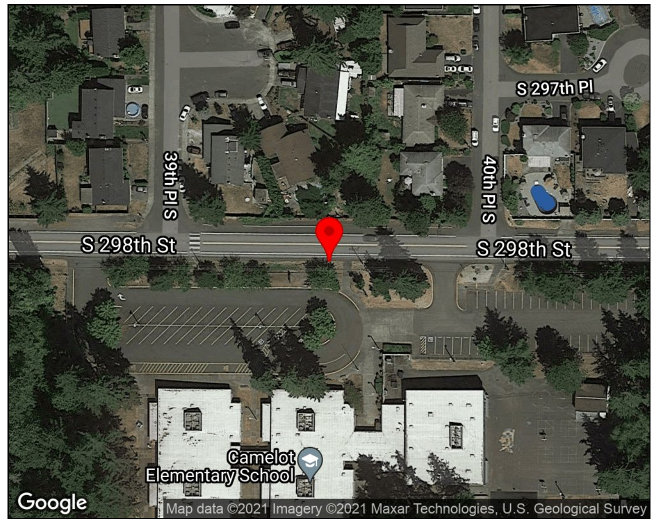
1. Federal Way, Camelot Elementary School, Main Building

1.1 Building Description

Building Name:	Main Building
Facility Name:	Camelot Elementary School
District Name:	Federal Way
ICOS Latitude:	47.334846
ICOS Longitude:	-122.284265
ICOS Building ID:	50675
ASCE 41 Bldg Type:	W2
Enrollment:	353
Gross Sq. Ft. :	41111
Year Built:	1964
Number of Stories:	1
S_{XS} BSE-2E:	1.213
S_{X1} BSE-2E:	0.511
ASCE 41 Level of Seismicity:	High
Site Class:	C
V_{S30}(m/s):	412
Liquefaction Potential:	very low
Tsunami Risk:	No
Structural Drawings Available:	Yes
Evaluating Firm:	WSP

** Liquification Potential and Tsunami Risk is based on publicly available state geologic hazard mapping.*



Camelot ES is composed of three, one-story wood shear wall structure with stucco/gravel facades on the exterior walls. The buildings were originally constructed in 1964 and had a renovation in 1988. The buildings are all roughly rectangular in plan. Building R is the Multi-Purpose Room and measures 90 by 81 feet. Buildings A & B classroom buildings that nearly identical in footprint and measure 187 by 72 feet. The buildings have mono slope roofs with Multipurpose Building R having average height of 22.5 feet, and Classroom Buildings A & B having an average height of 12.5 feet. The building roofs are interconnected with a series of breezeway roof segments.

1.1.1 Building Use

Building R is the Multipurpose building with a gymnasium and Kitchen. Buildings B and C have classrooms, Library, and Administrative spaces.

1.1.2 Structural System

Table 1-1. Structural System Description of Camelot Elementary School

Structural System	Description
Structural Roof	The roof is wood framed with wood structural panels over open-web trusses (Trus-Joists) spanning to wood stud bearing walls and glulam beams.
Structural Floor(s)	5-inch slab-on-grade, unreinforced (per existing drawings)
Foundations	The foundations are traditional shallow foundations: concrete strip footings at the exterior wall lines with slab-on-grade at the interior.
Gravity System	The primary gravity system is a combination of wood stud bearing walls and beam-systems. Roof loads are supported by sheathing and open-web wood trusses that span to roof beams and bearing walls supported by conventional spread footings.
Lateral System	Lateral forces are resisted by plywood sheathed roof diaphragms which transfers loads to plywood sheathed shear walls at the exterior and interior of the building. These shear walls transfer the lateral loads (seismic/wind) directly to the foundations.

1.1.3 Structural System Visual Condition

Table 1-2. Structural System Condition Description of Camelot Elementary School

Structural System	Description
Structural Roof	No visible signs of damage or deterioration.
Structural Floor(s)	Not applicable.
Foundations	No visible signs of damage or deterioration.
Gravity System	No visible signs of damage or deterioration.
Lateral System	No visible signs of damage or deterioration.

Figure 1-1. Exterior Building C

Figure 1-2. Gymnasium

Figure 1-3. Kitchen

Figure 1-4. Work Room

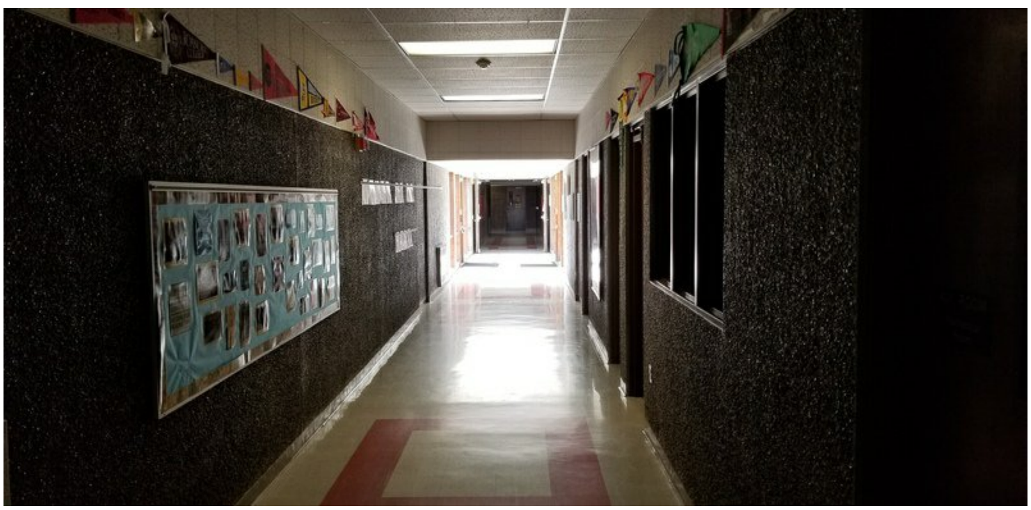


Figure 1-5. Typical Hallway

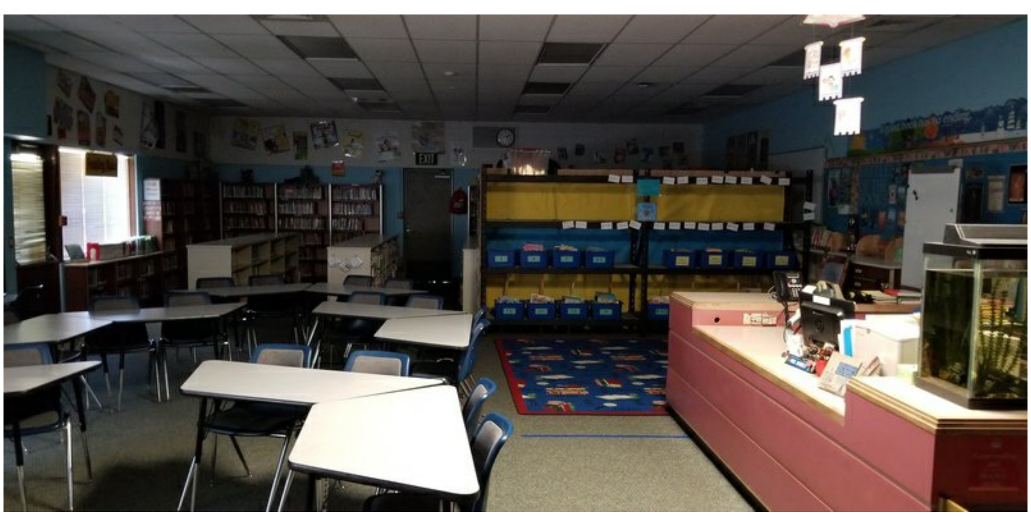


Figure 1-6. Typical Classroom

Figure 1-7. Conference Room

Figure 1-8. Supply Closet

Figure 1-9. Roof looking from Building A to Building B

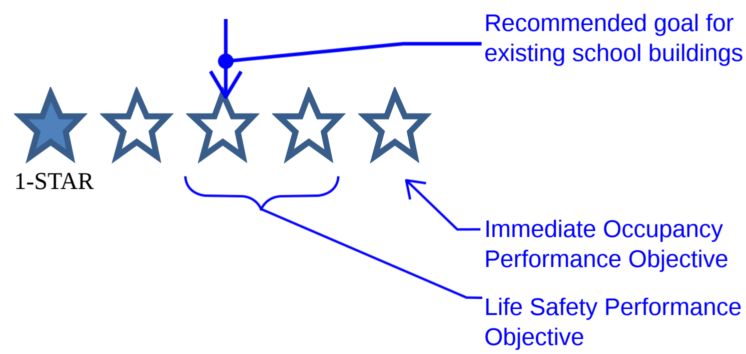
Figure 1-10. Exterior Roof Supports

1.1.4 Earthquake Performance Rating System - Structural Safety Rating

The seismic evaluation items from the ASCE 41 Tier 1 seismic evaluation checklist have been translated to a Structural Safety star-rating using the *EPRS ASCE 41-13 Translation Procedure*. There are two other safety sub-ratings using the EPRS *Translation Procedure*: a Geologic safety sub-rating and a Nonstructural safety sub-rating, that are not included below.

The structural safety star-rating below is a preliminary rating based on the information available for this study. The geologic checklist items have been excluded from the structural safety star-rating. If a building's structural safety star-rating is to be improved, it may also be necessary to further assess the geologic conditions of the building site. Determining the final star-rating of a building is intended to be an iterative process and preliminary ratings will often times be conservative until more field investigation, structural analysis, and engineering judgment is performed by a structural engineer. The intent in providing a preliminary star-rating as part of this study is to provide school districts with the action lists below to further improve the seismic performance and safety of the buildings that were assessed. The tables below indicate the Unknown (U) or Noncompliant (NC) structural seismic evaluation items that should be mitigated or further investigated to improve the Earthquake Performance Rating System (EPRS) structural safety rating for this building.

EPRS Structural Safety Rating for Camelot Elementary School, Main Building:



1-STAR	Risk of Collapse in Multiple or Widespread Locations (Expected performance as a whole would lead to multiple or widespread conditions known to be associated with earthquake-related collapse resulting in injury, entrapment, or death.)
2-STAR	Risk of Collapse in Isolated Locations (Expected performance in certain locations within or adjacent to the building would lead to conditions known to be associated with earthquake-related collapse resulting in injury, entrapment, or death.)
3-STAR	Loss of Life Unlikely (Expected performance results in conditions that are unlikely to cause severe structural damage or loss of life). A 3-star rating meets the Tier 1 Life Safety (LS) structural performance objective.
4-STAR	Serious Injuries Unlikely (Expected performance results in conditions that are associated with limited structural damage and are unlikely to cause serious injuries).
5-STAR	Injuries and Entrapment Unlikely (Expected performance results in conditions that are associated with minimal structural damage and are unlikely to cause injuries or keep people from exiting the building). A 5-star rating meets the Tier 1 Immediate Occupancy (IO) structural performance objective.

Table 1-3. Identified Seismic Evaluation Items to Address for an improved ★★ 2-STAR Rating

Evaluation Item	Tier 1 Screening	Description
Shear Stress Check	Noncompliant	It appears that both interior and exterior walls are used a shear walls, however, there still appear to be locations that are overstressed. There is a layer of heavy aggregate embedded cementitious finish on many of the walls that drastically increase the building seismic weight and overstress the shear walls..

Note: All of the evaluation items in Table 3 need to be assessed as Compliant (C) in order to achieve a 2-Star Structural Safety Rating.

Table 1-4. Additional Seismic Evaluation Items to Mitigate or Further Investigate for an improved ★★★ 3-STAR Rating

Evaluation Item	Tier 1 Evaluation	Description
Diagonally Sheathed and Unblocked Diaphragms	Noncompliant	The drawings indicate that only the ends of the classroom buildings (Buildings B and C) are blocked, approximately 8% of the diaphragm at each end. It is assumed that the remaining 84% of the diaphragms in between are not blocked and exceeds 40 feet in some locations. Further investigation is required, and diaphragm strengthening may be needed to mitigate seismic risk.

Note: Tables 3 and 4 are cumulative. All of the evaluation items in Table 4 need to be assessed as Compliant (C) in addition to all of the evaluation items in Table 3 being assessed as Compliant (C), in order to achieve a 3-Star Structural Safety Rating.

The Structural Safety star-rating contained in this report is based on ASCE 41 Tier 1 Screening Checklists only. These seismic screening checklists are often the first step employed by structural engineers when trying to determine the seismic vulnerabilities of existing buildings and to begin a process of mitigating these seismic vulnerabilities. School district facilities management personnel and their design consultants should be able to take advantage of this information to help inform and address seismic risks in existing or future renovation, repair, or modernization projects.

It is important to note that information used for these school seismic screenings was limited to available construction drawings and limited site observations by our team of licensed structural engineers. In some cases, construction drawings were not available for review. Due to the limited scope of the study, our team of engineers were not able to perform more-detailed investigations above ceilings, behind wall finishes, in confined spaces, or in other areas obstructed from view. In many cases, further investigation and engineering analysis may find that items marked as unknown or noncompliant may not require seismic mitigation if it is shown that the existing structure is acceptable in its current state. In these cases, further investigation and engineering analysis should be conducted ahead of a seismic upgrade construction project, especially when a building is marked as having many unknown items.

1.2 Seismic Evaluation Findings

1.2.1 Structural Seismic Deficiencies

The structural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is also provided based on this evaluation.

Table 1-5. Identified Structural Seismic Deficiencies for Federal Way Camelot Elementary School Main Building

Deficiency	Description
Shear Stress Check	It appears that both interior and exterior walls are used a shear walls, however, there still appear to be locations that are overstressed. There is a layer of heavy aggregate embedded cementitious finish on many of the walls that drastically increase the building seismic weight and overstress the shear walls..
Diagonally Sheathed and Unblocked Diaphragms	The drawings indicate that only the ends of the classroom buildings (Buildings B and C) are blocked, approximately 8% of the diaphragm at each end. It is assumed that the remaining 84% of the diaphragms in between are not blocked and exceeds 40 feet in some locations. Further investigation is required, and diaphragm strengthening may be needed to mitigate seismic risk.

1.2.2 Structural Checklist Items Marked as Unknown

Where building structural component seismic adequacy was unknown due to lack of available information or limited observation, the structural checklist items were marked as "unknown". These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown structural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is also provided based on the evaluation.

Table 1-6. Identified Structural Checklist Items Marked as Unknown for Federal Way Camelot Elementary School Main Building

Unknown Item	Description
Liquefaction	The liquefaction potential of site soils is unknown at this time given available information. very low liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.
Surface Fault Rupture	The site is located within 5 miles of a mapped fault according to DNR state mapping. Further investigation by a licensed geotechnical engineer is necessary to determine the potential for surface fault rupture at the site.

1.3.1 Nonstructural Seismic Deficiencies

The nonstructural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is also provided based on this evaluation. Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require more substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

Table 1-7. Identified Nonstructural Seismic Deficiencies for Federal Way Camelot Elementary School Main Building

Deficiency	Description
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	Tall and narrow contents should be braced or anchored to the structure.
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	Fall prone items of 20 lb or more stored over 4 feet above the ground should be braced or restrained.

1.3.2 Nonstructural Checklist Items Marked as Unknown

Where building nonstructural component seismic adequacy was unknown due to lack of available information or limited observation, the nonstructural checklist items were marked as “unknown”. These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown nonstructural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is also provided based on the evaluation.

Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require more substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

Table 1-8. Identified Nonstructural Checklist Items Marked as Unknown for Federal Way Camelot Elementary School Main Building

Unknown Item	Description
P-3 Drift. HR-not required; LS-MH; PR-MH.	Details of the partitions with rigid cementitious finishes were not available to determine if the partitions can accommodate 2% lateral drift.
LF-1 Independent Support. HR-not required; LS-MH; PR-MH.	The light fixtures in dropped acoustical ceilings were not observed during the field visit. Maintenance and facility staff should verify that each fixture is independently supported to the roof structure with two wires at opposite corners to prevent fixtures and live conduit from following during a seismic event.

Federal Way, Camelot Elementary School, Main Building

17-2 Collapse Prevention Basic Configuration Checklist

Building record drawings have been reviewed, when available, and a non-destructive field investigation has been performed for the subject building. Each of the required checklist items are marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U). Items marked Compliant indicate conditions that satisfy the performance objective, whereas items marked Noncompliant or Unknown indicate conditions that do not. Certain statements might not apply to the building being evaluated.

Low Seismicity

Building System - General

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Load Path	The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Tier 2: Sec. 5.4.1.1; Commentary: Sec. A.2.1.10)	X				
Adjacent Buildings	The clear distance between the building being evaluated and any adjacent building is greater than 0.25% of the height of the shorter building in low seismicity, 0.5% in moderate seismicity, and 1.5% in high seismicity. (Tier 2: Sec. 5.4.1.2; Commentary: Sec. A.2.1.2)	X				
Mezzanines	Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Tier 2: Sec. 5.4.1.3; Commentary: Sec. A.2.1.3)			X		This building is a single story structure with no mezzanines.

Building System - Building Configuration

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Weak Story	The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Tier 2: Sec. 5.4.2.1; Commentary: Sec. A.2.2.2)			X		Not applicable to single story buildings.
Soft Story	The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Tier 2: Sec. 5.4.2.2; Commentary: Sec. A.2.2.3)			X		Not applicable to single story buildings.
Vertical Irregularities	All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Tier 2: Sec. 5.4.2.3; Commentary: Sec. A.2.2.4)			X		Not applicable to single story buildings.

Geometry	There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Tier 2: Sec. 5.4.2.4; Commentary: Sec. A.2.2.5)			X		Not applicable to single story buildings.
Mass	There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Tier 2: Sec. 5.4.2.5; Commentary: Sec. A.2.2.6)			X		Not applicable to single story buildings.
Torsion	The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Tier 2: Sec. 5.4.2.6; Commentary: Sec. A.2.2.7)			X		The roof diaphragms are flexible wood diaphragms. Flexible diaphragms are not susceptible to torsional irregularity.

Moderate Seismicity **(Complete the Following Items in Addition to the Items for Low Seismicity)**

Geologic Site Hazards

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Liquefaction	Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building’s seismic performance do not exist in the foundation soils at depths within 50 ft (15.2 m) under the building. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.1)				X	The liquefaction potential of site soils is unknown at this time given available information. very low liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.
Slope Failure	The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.2)			X		Building is on a flat site.
Surface Fault Rupture	Surface fault rupture and surface displacement at the building site are not anticipated. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.3)				X	The site is located within 5 miles of a mapped fault according to DNR state mapping. Further investigation by a licensed geotechnical engineer is necessary to determine the potential for surface fault rupture at the site.

High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)

Foundation Configuration

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Overturning	The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (Tier 2: Sec. 5.4.3.3; Commentary: Sec. A.6.2.1)	X				
Ties Between Foundation Elements	The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Tier 2: Sec. 5.4.3.4; Commentary: Sec. A.6.2.2)	X				

17-6 Collapse Prevention Structural Checklist for Building Type W2

Building record drawings have been reviewed, when available, and a non-destructive field investigation has been performed for the subject building. Each of the required checklist items are marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U). Items marked Compliant indicate conditions that satisfy the performance objective, whereas items marked Noncompliant or Unknown indicate conditions that do not. Certain statements might not apply to the building being evaluated.

Low and Moderate Seismicity

Seismic-Force-Resisting System

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Redundancy	The number of lines of shear walls in each principal direction is greater than or equal to 2. (Tier 2: Sec. 5.5.1.1; Commentary: Sec. A.3.2.1.1)	X				
Shear Stress Check	The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the following values: Structural panel sheathing – 1,000 lb/ft; Diagonal sheathing – 700 lb/ft; Straight sheathing – 100 lb/ft; All other conditions – 100 lb/ft. (Tier 2: Sec. 5.5.3.1.1; Commentary: Sec. A.3.2.7.1)		X			It appears that both interior and exterior walls are used a shear walls, however, there still appear to be locations that are overstressed. There is a layer of heavy aggregate embedded cementitious finish on many of the walls that drastically increase the building seismic weight and overstress the shear walls..
Stucco (Exterior Plaster) Shear Walls	Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. (Tier 2: Sec. 5.5.3.6.1; Commentary: Sec. A.3.2.7.2)			X		Building is a single-story structure.
Gypsum Wallboard or Plaster Shear Walls	Interior plaster or gypsum wallboard is not used for shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. (Tier 2: Sec. 5.5.3.6.1; Commentary: Sec. A.3.2.7.3)			X		Building is a single-story structure.
Narrow Wood Shear Walls	Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces. (Tier 2: Sec. 5.5.3.6.1; Commentary: Sec. A.3.2.7.4)	X				
Walls Connected Through Floors	Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. (Tier 2: Sec. 5.5.3.6.2; Commentary: Sec. A.3.2.7.5)			X		Building is a single-story structure.
Hillside Site	For structures that are taller on at least one side by more than one-half story because of a sloping site, all shear walls on the downhill slope have an aspect ratio less than 1-to-1. (Tier 2: Sec. 5.5.3.6.3; Commentary: Sec. A.3.2.7.6)			X		Building is on a level site.

Cripple Walls	Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels. (Tier 2: Sec. 5.5.3.6.4; Commentary: Sec. A.3.2.7.7)			X		No cripple walls found.
Openings	Walls with openings greater than 80% of the length are braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or are supported by adjacent construction through positive ties capable of transferring the seismic forces. (Tier 2: Sec. 5.5.3.6.5; Commentary: Sec. A.3.2.7.8)			X		The building does not contain windows larger than 80% of the total wall length.

Connections

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Wood Posts	There is a positive connection of wood posts to the foundation. (Tier 2: Sec. 5.7.3.3; Commentary: Sec. A.5.3.3)	X				
Wood Sills	All wood sills are bolted to the foundation. (Tier 2: Sec. 5.7.3.3; Commentary: Sec. A.5.3.4)	X				
Girder-Column Connection	There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 5.7.4.1; Commentary: Sec. A.5.4.1)	X				

High Seismicity (Complete the Following Items in Addition to the Items for Low & Moderate Seismicity)

Connections

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Wood Sill Bolts	Sill bolts are spaced at 6 ft (1.8 m) or less with acceptable edge and end distance provided for wood and concrete. (Tier 2: Sec. 5.7.3.3; Commentary: Sec. A.5.3.7)	X				

Diaphragms

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Diaphragm Continuity	The diaphragms are not composed of split-level floors and do not have expansion joints. (Tier 2: Sec. 5.6.1.1; Commentary: Sec. A.4.1.1)	X				
Roof Chord Continuity	All chord elements are continuous, regardless of changes in roof elevation. (Tier 2: Sec. 5.6.1.1; Commentary: Sec. A.4.1.3)	X				
Diaphragm Reinforcement at Openings	There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. (Tier 2: Sec. 5.6.1.5; Commentary: Sec. A.4.1.8)			X		There are no large diaphragm openings.

Straight Sheathing	All straight-sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.1)	X				The only area where this applies is over the mechanical rooms, however, the straight sheathing is topped with wood structural panels, thus the diaphragm is believed to rely on the wood structural panels.
Spans	All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.2)	X				
Diagonally Sheathed and Unblocked Diaphragms	All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and have aspect ratios less than or equal to 4-to-1. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.3)		X			The drawings indicate that only the ends of the classroom buildings (Buildings B and C) are blocked, approximately 8% of the diaphragm at each end. It is assumed that the remaining 84% of the diaphragms in between are not blocked and exceeds 40 feet in some locations. Further investigation is required, and diaphragm strengthening may be needed to mitigate seismic risk.
Other Diaphragms	The diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 5.6.5; Commentary: Sec. A.4.7.1)	X				

Federal Way, Camelot Elementary School, Main Building

17-38 Nonstructural Checklist

Notes:
C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.
Performance Level: HR = Hazards Reduced, LS = Life Safety, and PR = Position Retention.
Level of Seismicity: L = Low, M = Moderate, and H = High

Life Safety Systems

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
LSS-1 Fire Suppression Piping. HR-not required; LS-LMH; PR-LMH.	Fire suppression piping is anchored and braced in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.1)			X		No fire supression system found.
LSS-2 Flexible Couplings. HR-not required; LS-LMH; PR-LMH.	Fire suppression piping has flexible couplings in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.2)			X		No fire supression system found.
LSS-3 Emergency Power. HR-not required; LS-LMH; PR-LMH.	Equipment used to power or control Life Safety systems is anchored or braced. (Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.1)			X		No emergency power found.
LSS-4 Stair and Smoke Ducts. HR-not required; LS-LMH; PR-LMH.	Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.1)			X		No fire supression system found.
LSS-5 Sprinkler Ceiling Clearance. HR-not required; LS-MH; PR-MH.	Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.3)			X		No fire supression system found.
LSS-6 Emergency Lighting. HR-not required; LS-not required; PR-LMH	Emergency and egress lighting equipment is anchored or braced. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.1)			X		Not required.

Hazardous Materials

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
HM-1 Hazardous Material Equipment. HR-LMH; LS-LMH; PR-LMH.	Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.2)			X		Hazardous material equipment not found.
HM-2 Hazardous Material Storage. HR-LMH; LS-LMH; PR-LMH.	Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (Tier 2: Sec. 13.8.3; Commentary: Sec. A.7.15.1)			X		Hazardous material storage not found.
HM-3 Hazardous Material Distribution. HR-MH; LS-MH; PR-MH.	Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)			X		Hazardous material distribution not found.

HM-4 Shutoff Valves. HR-MH; LS-MH; PR-MH.	Piping containing hazardous material, including natural gas, has shutoff valves or other devices to limit spills or leaks. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.3)			X		Hazardous material distribution not found.
HM-5 Flexible Couplings. HR-LMH; LS-LMH; PR-LMH.	Hazardous material ductwork and piping, including natural gas piping, have flexible couplings. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.15.4)			X		Hazardous material distribution not found.
HM-6 Piping or Ducts Crossing Seismic Joints. HR-MH; LS-MH; PR-MH.	Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.3, 13.7.5, 13.7.6; Commentary: Sec. A.7.13.6)			X		Hazardous material distribution not found.

Partitions

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
P-1 Unreinforced Masonry. HR-LMH; LS-LMH; PR-LMH.	Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft (3.0 m) in Low or Moderate Seismicity, or at most 6 ft (1.8 m) in High Seismicity. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.1)			X		Unreinforced masonry or hollow-clay tile partitions not present.
P-2 Heavy Partitions Supported by Ceilings. HR-LMH; LS-LMH; PR-LMH.	The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.2.1)	X				
P-3 Drift. HR-not required; LS-MH; PR-MH.	Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.2)				X	Details of the partitions with rigid cementitious finishes were not available to determine if the partitions can accommodate 2% lateral drift.
P-4 Light Partitions Supported by Ceilings. HR-not required; LS-not required; PR-MH.	The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.2.1)			X		Not required.
P-5 Structural Separations. HR-not required; LS-not required; PR-MH.	Partitions that cross structural separations have seismic or control joints. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.3)			X		Not required.
P-6 Tops. HR-not required; LS-not required; PR-MH.	The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft (1.8 m). (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.4)			X		Not required.

Ceilings

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
C-1 Suspended Lath and Plaster. HR-H; LS-MH; PR-LMH.	Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft2 (1.1 m2) of area. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.3)			X		Lath and plaster ceilings not present.
C-2 Suspended Gypsum Board. HR-not required; LS-MH; PR-LMH.	Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft2 (1.1 m2) of area. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.3)			X		Suspended gypsum board ceilings not found.
C-3 Integrated Ceilings. HR-not required; LS-not required; PR-MH.	Integrated suspended ceilings with continuous areas greater than 144 ft2 (13.4 m2) and ceilings of smaller areas that are not surrounded by restraining partitions are laterally restrained at a spacing no greater than 12 ft (3.6 m) with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.2)			X		Not required.
C-4 Edge Clearance. HR-not required; LS-not required; PR-MH.	The free edges of integrated suspended ceilings with continuous areas greater than 144 ft2 (13.4 m2) have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in. (13 mm); in High Seismicity, 3/4 in. (19 mm). (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.4)			X		Not required.
C-5 Continuity Across Structure Joints. HR-not required; LS-not required; PR-MH.	The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.5)			X		Not required.
C-6 Edge Support. HR-not required; LS-not required; PR-H.	The free edges of integrated suspended ceilings with continuous areas greater than 144 ft2 (13.4 m2) are supported by closure angles or channels not less than 2 in. (51 mm) wide. (Tier 2: Sec. 13.6.4 ; Commentary: Sec. A.7.2.6)			X		Not required.
C-7 Seismic Joints. HR-not required; LS-not required; PR-H.	Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2,500 ft2 (232.3 m2) and has a ratio of long-to-short dimension no more than 4-to-1. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.7)			X		Not required.

Light Fixtures

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
LF-1 Independent Support. HR-not required; LS-MH; PR-MH.	Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (Tier 2: Sec. 13.6.4, 13.7.9; Commentary: Sec. A.7.3.2)				X	The light fixtures in dropped acoustical ceilings were not observed during the field visit. Maintenance and facility staff should verify that each fixture is independently supported to the roof structure with two wires at opposite corners to prevent fixtures and live conduit from following during a seismic event.
LF-2 Pendant Supports. HR-not required; LS-not required; PR-H.	Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft. Unbraced suspended fixtures are free to allow a 360-degree range of motion at an angle not less than 45 degrees from horizontal without contacting adjacent components. Alternatively, if rigidly supported and/or braced, they are free to move with the structure to which they are attached without damaging adjoining components. Additionally, the connection to the structure is capable of accommodating the movement without failure. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.3)			X		Not required.
LF-3 Lens Covers. HR-not required; LS-not required; PR-H.	Lens covers on light fixtures are attached with safety devices. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.4)			X		Not required.

Cladding and Glazing

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
CG-1 Cladding Anchors. HR-MH; LS-MH; PR-MH.	Cladding components weighing more than 10 lb/ft2 (0.48 kN/m2) are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft (1.8 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft (1.2 m) (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.1)			X		Panelized cladding system not present.

CG-2 Cladding Isolation. HR-not required; LS-MH; PR-MH.	For steel or concrete moment-frame buildings, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02, and the rods have a length-to-diameter ratio of 4.0 or less. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.3)			X		Panelized cladding system not present.
CG-3 Multi-Story Panels. HR-MH; LS-MH; PR-MH.	For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02, and the rods have a length-to-diameter ratio of 4.0 or less. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.4)			X		Panelized cladding system not present.
CG-4 Threaded Rods. HR-not required; LS-MH; PR-MH.	Threaded rods for panel connections detailed to accommodate drift by bending of the rod have a length-to-diameter ratio greater than 0.06 times the story height in inches for Life Safety in Moderate Seismicity and 0.12 times the story height in inches for Life Safety in High Seismicity and Position Retention in any seismicity. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.9)			X		Panelized cladding system not present.
CG-5 Panel Connections. HR-MH; LS-MH; PR-MH.	Cladding panels are anchored out of plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.5)			X		Panelized cladding system not present.
CG-6 Bearing Connections. HR-MH; LS-MH; PR-MH.	Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.6)			X		Panelized cladding system not present.
CG-7 Inserts. HR-MH; LS-MH; PR-MH.	Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.7)			X		Panelized cladding system not present.

CG-8 Overhead Glazing. HR-not required; LS-MH; PR-MH.	Glazing panes of any size in curtain walls and individual interior or exterior panes more than 16 ft2 (1.5 m2) in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (Tier 2: Sec. 13.6.1.5; Commentary: Sec. A.7.4.8)			X		Curtain walls or panes greater than 16 square feet not found.

Masonry Veneer

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
M-1 Ties. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft2 (0.25 m2), and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in. (914 mm); for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (610 mm). (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.1)			X		Masonry veneer not found.
M-2 Shelf Angles. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.2)			X		Masonry veneer not found.
M-3 Weakened Planes. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.3)			X		Masonry veneer not found.
M-4 Unreinforced Masonry Backup. HR-LMH; LS-LMH; PR-LMH.	There is no unreinforced masonry backup. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.2)			X		Masonry veneer not found.
M-5 Stud Tracks. HR-not required; LS-MH; PR-MH.	For veneer with coldformed steel stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. (610 mm) on center. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.6.)			X		No backing studs found.
M-6 Anchorage. HR-not required; LS-MH; PR-MH.	For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.1)			X		Masonry veneer not found.
M-7 Weep Holes. HR-not required; LS-not required; PR-MH.	In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.6)			X		Not required.
M-8 Openings. HR-not required; LS-not required; PR-MH.	For veneer with cold-formed-steel stud backup, steel studs frame window and door openings. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.6.2)			X		Not required.

Parapets, Cornices, Ornamentation, and Appendages

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
PCOA-1 URM Parapets or Cornices. HR-LMH; LS-LMH; PR-LMH.	Laterally unsupported unreinforced masonry parapets or cornices have height-tothickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.1)			X		No URM parapets or cornices not found.
PCOA-2 Canopies. HR-not required; LS-LMH; PR-LMH.	Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft (3.0 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft (1.8 m). (Tier 2: Sec. 13.6.6; Commentary: Sec. A.7.8.2)			X		Canopies not found.
PCOA-3 Concrete Parapets. HR-H; LS-MH; PR-LMH.	Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.3)			X		Concrete parapets not present.
PCOA-4 Appendages. HR-MH; LS-MH; PR-LMH.	Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft (1.8 m). This evaluation statement item does not apply to parapets or cornices covered by other evaluation statements. (Tier 2: Sec. 13.6.6; Commentary: Sec. A.7.8.4)			X		No appendages present.

Masonry Chimneys

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
MC-1 URM Chimneys. HR-LMH; LS-LMH; PR-LMH.	Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (Tier 2: Sec. 13.6.7; Commentary: Sec. A.7.9.1)			X		Unreinforced masonry chimneys not found.
MC-2 Anchorage. HR-LMH; LS-LMH; PR-LMH.	Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (Tier 2: Sec. 13.6.7; Commentary: Sec. A.7.9.2)			X		Unreinforced masonry chimneys not found.

Stairs

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
S-1 Stair Enclosures. HR-not required; LS-LMH; PR-LMH.	Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out of plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (Tier 2: Sec. 13.6.2, 13.6.8; Commentary: Sec. A.7.10.1)			X		There are no stairs at this structure.
S-2 Stair Details. HR-not required; LS-LMH; PR-LMH.	The connection between the stairs and the structure does not rely on post-installed anchors in concrete or masonry, and the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.4.3.1 for moment-frame structures or 0.5 in. for all other structures without including any lateral stiffness contribution from the stairs. (Tier 2: Sec. 13.6.8; Commentary: Sec. A.7.10.2)			X		There are no stairs at this structure.

Contents and Furnishings

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
CF-1 Industrial Storage Racks. HR-LMH; LS-MH; PR-MH.	Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/RMI MH 16.1 as modified by ASCE 7, Chapter 15. (Tier 2: Sec. 13.8.1; Commentary: Sec. A.7.11.1)			X		Industrial storage racks not present.
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	Contents more than 6 ft (1.8 m) high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.2)		X			Tall and narrow contents should be braced or anchored to the structure.
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	Equipment, stored items, or other contents weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level are braced or otherwise restrained. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.3)		X			Fall prone items of 20 lb or more stored over 4 feet above the ground should be braced or restrained.
CF-4 Access Floors. HR-not required; LS-not required; PR-MH.	Access floors more than 9 in. (229 mm) high are braced. (Tier 2: Sec. 13.6.10; Commentary: Sec. A.7.11.4)			X		Not required.
CF-5 Equipment on Access Floors. HR-not required; LS-not required; PR-MH.	Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (Tier 2: Sec. 13.7.7 13.6.10; Commentary: Sec. A.7.11.5)			X		Not required.

CF-6 Suspended Contents. HR-not required; LS-not required; PR-H.	Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.6)			X		Not required.

Mechanical and Electrical Equipment

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
ME-1 Fall-Prone Equipment. HR-not required; LS-H; PR-H.	Equipment weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level, and which is not in-line equipment, is braced. (Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.4)			X		Fall prone mechanical equipment not found.
ME-2 In-Line Equipment. HR-not required; LS-H; PR-H.	Equipment installed in line with a duct or piping system, with an operating weight more than 75 lb (34.0 kg), is supported and laterally braced independent of the duct or piping system. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.5)			X		Inline equipment not observed.
ME-3 Tall Narrow Equipment. HR-not required; LS-H; PR-MH.	Equipment more than 6 ft (1.8 m) high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.6)			X		Tall-narrow equipment not observed.
ME-4 Mechanical Doors. HR-not required; LS-not required; PR-MH.	Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (Tier 2: Sec. 13.6.9; Commentary: Sec. A.7.12.7)			X		Not required.
ME-5 Suspended Equipment. HR-not required; LS-not required; PR-H.	Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (Tier 2: Sec. 13.7.1, 13.7.7; Commentary: Sec. A.7.12.8)			X		Not required.
ME-6 Vibration Isolators. HR-not required; LS-not required; PR-H.	Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.9)			X		Not required.
ME-7 Heavy Equipment. HR-not required; LS-not required; PR-H.	Floor supported or platform-supported equipment weighing more than 400 lb (181.4 kg) is anchored to the structure. (Tier 2: Sec. 13.7.1, 13.7.7; Commentary: Sec. A.7.12.10)			X		Not required.
ME-8 Electrical Equipment. HR-not required; LS-not required; PR-H.	Electrical equipment is laterally braced to the structure. (Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.11)			X		Not required.
ME-9 Conduit Couplings. HR-not required; LS-not required; PR-H.	Conduit greater than 2.5 in. (64 mm) trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (Tier 2: Sec. 13.7.8; Commentary: Sec. A.7.12.12)			X		Not required.

Piping

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
PP-1 Flexible Couplings. HR-not required; LS-not required; PR-H.	Fluid and gas piping has flexible couplings. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.2)			X		Not required.
PP-2 Fluid and Gas Piping. HR-not required; LS-not required; PR-H.	Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)			X		Not required.
PP-3 C-Clamps. HR-not required; LS-not required; PR-H.	One-sided C-clamps that support piping larger than 2.5 in. (64 mm) in diameter are restrained. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.5)			X		Not required.
PP-4 Piping Crossing Seismic Joints. HR-not required; LS-not required; PR-H.	Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.6)			X		Not required.

Ducts

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
D-1 Duct Bracing. HR-not required; LS-not required; PR-H.	Rectangular ductwork larger than 6 ft2 (0.56 m2) in cross-sectional area and round ducts larger than 28 in. (711 mm) in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft (9.2 m). The maximum spacing of longitudinal bracing does not exceed 60 ft (18.3 m). (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.2)			X		Not required.
D-2 Duct Support. HR-not required; LS-not required; PR-H.	Ducts are not supported by piping or electrical conduit. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.3)			X		Not required.
D-3 Ducts Crossing Seismic Joints. HR-not required; LS-not required; PR-H.	Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.4)			X		Not required.

Elevators

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
EL-1 Retainer Guards. HR-not required; LS-H; PR-H.	Sheaves and drums have cable retainer guards. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.1)			X		No elevators found.
EL-2 Retainer Plate. HR-not required; LS-H; PR-H.	A retainer plate is present at the top and bottom of both car and counterweight. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.2)			X		No elevators found.

EL-3 Elevator Equipment. HR-not required; LS-not required; PR-H.	Equipment, piping, and other components that are part of the elevator system are anchored. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.3)			X		Not required.
EL-4 Seismic Switch. HR-not required; LS-not required; PR-H.	Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.4)			X		Not required.
EL-5 Shaft Walls. HR-not required; LS-not required; PR-H.	Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.5)			X		Not required.
EL-6 Counterweight Rails. HR-not required; LS-not required; PR-H.	All counterweight rails and divider beams are sized in accordance with ASME A17.1. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.6)			X		Not required.
EL-7 Brackets. HR-not required; LS-not required; PR-H.	The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.7)			X		Not required.
EL-8 Spreader Bracket. HR-not required; LS-not required; PR-H.	Spreader brackets are not used to resist seismic forces. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.8)			X		Not required.
EL-9 Go-Slow Elevators. HR-not required; LS-not required; PR-H.	The building has a go-slow elevator system. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.9)			X		Not required.

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Appendix B: Concept-Level Seismic Upgrade Figures

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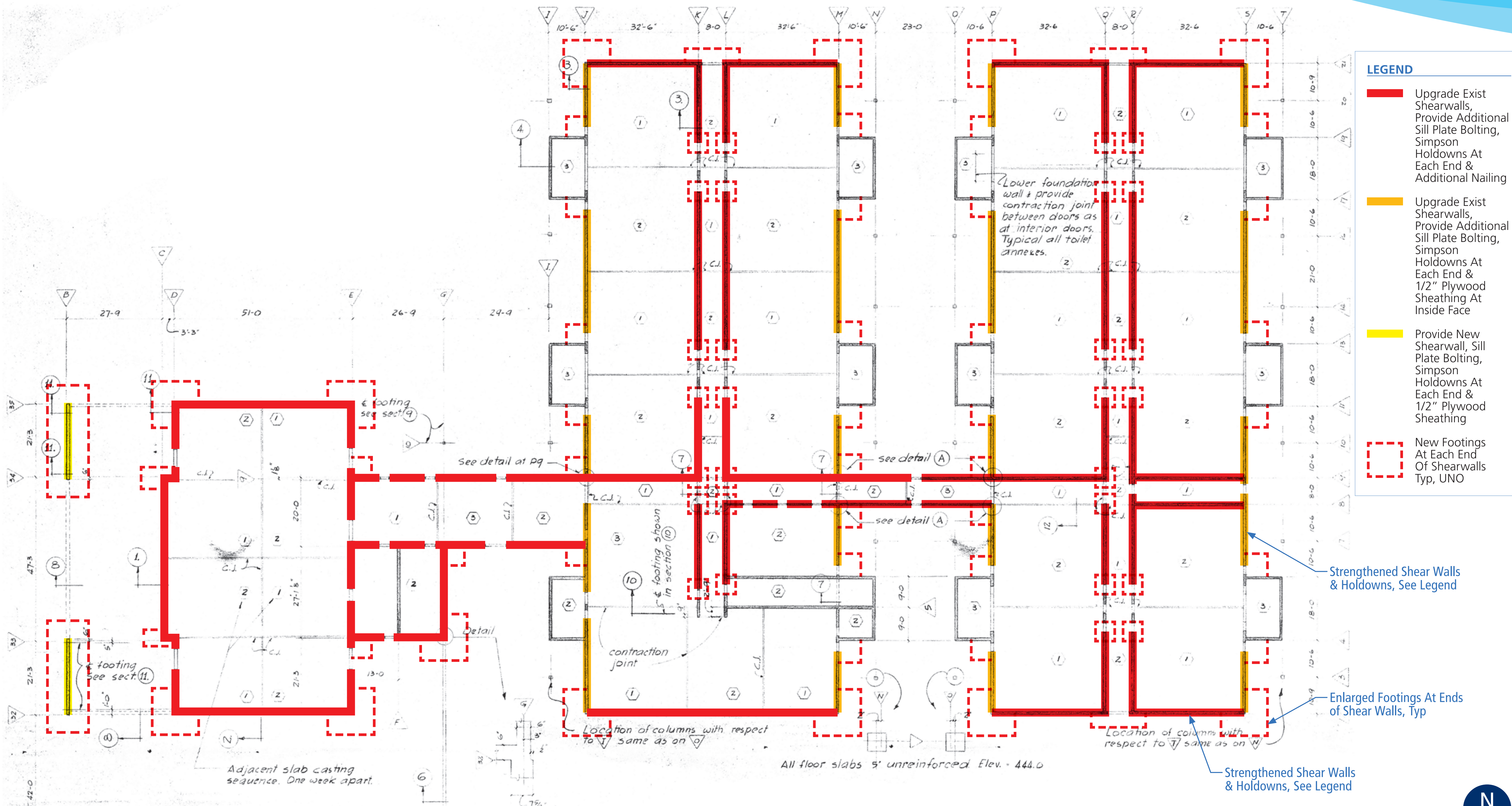


NOTES

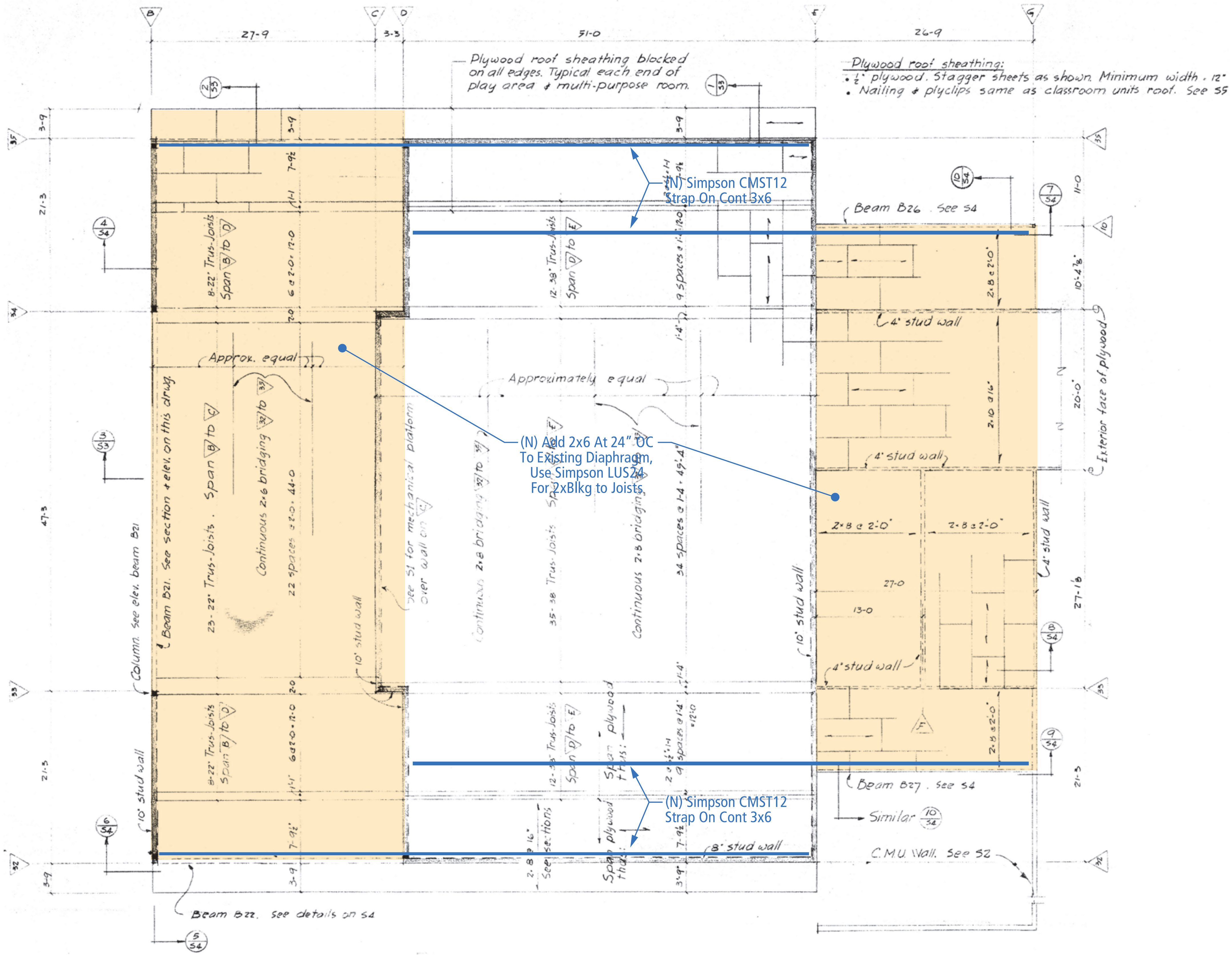
1. Alternate design possibility: stucco pea gravel finishes may be removed as an alternate, thereby reducing shear wall induced loads resulting in comparatively light holdowns and smaller footings.

ReidMiddleton

Camelot Elementary School Seismic Upgrades – Main Building

Washington State School Seismic Safety Assessments Project – Federal Way School District – June 2021

Figure 1 – Foundation Plan



LEGEND

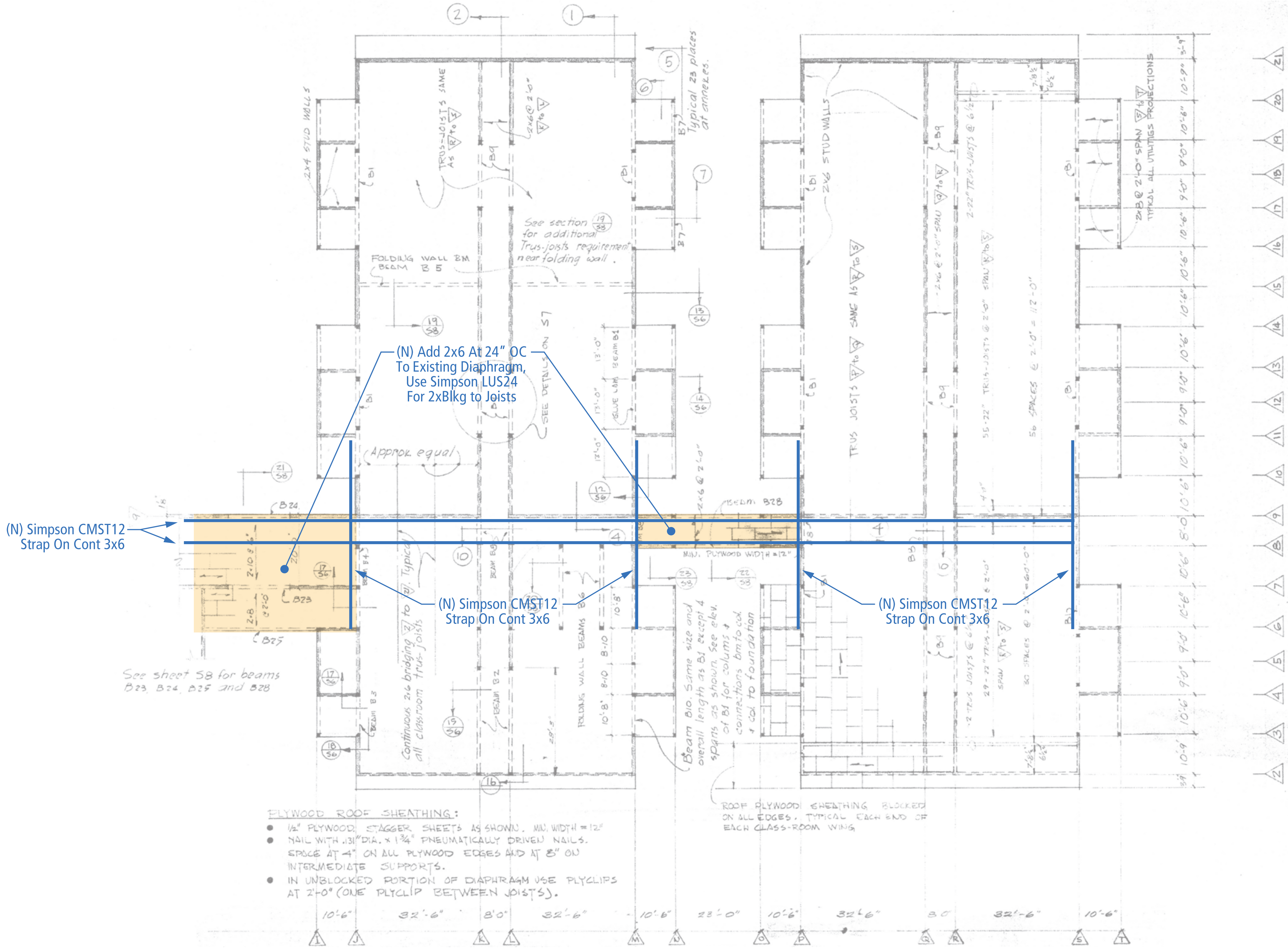
Blocked Diaphragm

ReidMiddleton

Camelot Elementary School Seismic Upgrades – Main Building

Washington State School Seismic Safety Assessments Project – Federal Way School District – June 2021

Figure 2 – Roof Plan



LEGEND

Blocked Diaphragm

Figure 3 – Roof & Framing Plan

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Appendix C: Opinion of Probable Construction Costs

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PD PRODIMS
PROJECT MANAGEMENT SERVICES

520 Kirkland Way, Suite 301
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Name:	**Wa State School Seismic Safety Assessment Phase 2**
Second Name:	**Camelot Elementary School Main**
Location:	**Auburn, WA**
Design Phase:	**ROM Cost Estimates**
Date of Estimate:	**February 11, 2021**
Date of Revision:	**April 9, 2021/June 8, 2021**
Month of Cost Basis:	**1Q, 2021**

Camelot Elementary School Main Building

Master Estimate Summary

Project Name	Construction Cost Type	Estimated Construction Cost
Camelot Elementary School Main Building	Structural Costs	$3,275,070
Camelot Elementary School Main Building	Non-Structural Costs	$1,637,535
TOTAL ESTIMATED CONSTRUCTION COST →		**$4,912,605**

Soft Costs	Soft Costs % Construction Cost	Estimated Soft Costs
Project Soft Cost Allowance	40.0%	$1,965,042
		Sum of the Above
TOTAL ESTIMATED PROJECT COST →		**$6,877,646**

Estimate Assumptions:

The ROM Construction Cost estimates are based on the Concept Design Report for the Project.
Construction Escalation is not included. Costs are current as of the month of Cost Basis noted above right.

Estimate Qualifications:

The ROM estimates are not be relied on solely for proforma development and financial decisions.
Further design work is required to determine construction budgets.
All Buildings Estimated to the 5' foot line for Utilities, All Sitework is estimated to go with any combination of the buildings and alternatives.
The ROM estimates do not include any Hazardous Material Abatement/Disposal.
For Construction Cost Markups they are additive, not cumulative. Percentages are added to the previous subtotal rather than the direct cost subtotal.
Owner Soft Costs Allowance are: A/E design fees, QA/QC, Project Administration, Owners Project Contingency, Average Washington State Sale Tax and
Estimated labor is based on an 8 hour per day shift 5 days a week. Accelerated schedule work of overtime has not been included.
Estimated labor is based on working on unoccupied facility without phased construction.
Estimate is based on a competitive public bid with at least 3 bona fide submitted and unrescinded general contractor bids.
Estimate is based on a competitive public bid with a minimum 6 week bidding schedule and no significant addendums within 2 weeks of bid opening.
State of Washington General Contractor/ Construction Manager (GC/CM) contracts typically raises construction costs. It is Not Included in this estimate.
Estimated construction cost is for the entire project. This estimate is not intended to be used for other projects.
Please consult the cost estimator for any modifications to this estimate. Unilaterally adding and deleting markups, scope of work, schedule, specifications, plans and bid forms could incorrectly restate the project construction cost.
Construction reserve contingency for change orders is not included in the estimate.
Sole source supply of materials and/ or installers typically results in a 40% to 100% premium on costs over open specifications.

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Structural Costs

Name:	Wa State School Seismic Safety Assessment Phase 2	Areas	sqft
Second Name:	Camelot Elementary School Main Building	Building Area	41,000
Location:	Auburn, WA		
Design Phase:	ROM Cost Estimates		
Date of Estimate:	February 11, 2021		
Date of Revision:	April 9, 2021/June 8, 2021		
Month of Cost Basis:	1Q, 2021	Total Areas	41,000

Camelot Elementary School Main Building

Construction Cost Estimate

Subtotal Direct Cost From the Estimate Detail Below $ 2,225,038

	Percentage of Previous Subtotal	Amount	Running Subtotal
Scope Contingency	10.0%	$ 222,504	$ 2,447,542
General Conditions	10.0%	$ 222,504	$ 2,670,046
Home Office Overhead	5.0%	$ 111,252	$ 2,781,298
Profit	6.0%	$ 133,502	$ 2,914,800
Escalation Included-Costs in 4Q, 2021 Dollars	12.4%	$ 360,269	$ 3,275,070
Washington State Sales Tax - Included in Soft Costs			

Total Markups Applied to the Direct Cost 47.19%
Markups are multiplied on each subtotal- They are not multiplied from the direct cost

		$/sqft
TOTAL ESTIMATED CONSTRUCTION COST--→	**$ 3,275,070**	**$ 79.88**
-20% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --→	**$ 2,620,056**	**$ 63.90**
+50% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --→	**$ 4,912,605**	**$ 119.82**

Please see the Master Summary for Assumptions and Qualifications for ROM Cost Estimates

Direct Cost of Construction

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
1 - Seismic Retrofit											
Foundations											
	Spread Footings System- Excavation, Backfill, Formwork, Concrete, Reinforcing and Detailing	70.2	cuyd	$ 716.25	$ 50,296.67	$ 238.75	$ 16,765.56	$ 57.30	$ 4,023.73	$ 1,012.30	$ 71,085.96
	Hold Down System - Nail to Wood Studs, Epoxy Anchor Bolt	144	each	$ 128.76	$ 18,541.44	$ 93.24	$ 13,426.56	$ 13.32	$ 1,918.08	$ 235.32	$ 33,886.08
Substructure											
	Demo/Resintall Slab on Grade System for New Footings Installation.	2,844	sqft	$ 9.90	$ 28,155.60	$ 8.10	$ 23,036.40	$ 1.08	$ 3,071.52	$ 19.08	$ 54,263.52
Superstructure											
Roof Systems											
	Upgrade Shearwall with Sill Bolts - Remove GWB and Reinstall	1,350	lnft	$ 11.52	$ 15,552.00	$ 4.48	$ 6,048.00	$ 0.96	$ 1,296.00	$ 16.96	$ 22,896.00
	Upgrade Shearwall with 1/2" Plywood Sheathing with Sill Bolts - Remove GWB and Reinstall	7,375	sqft	$ 4.23	$ 31,159.38	$ 2.28	$ 16,778.13	$ 0.39	$ 2,876.25	$ 6.89	$ 50,813.75
	New Shearwall with 1/2" Plywood Sheathing with Sill Bolts - Remove GWB and Reinstall	935	sqft	$ 4.68	$ 4,378.89	$ 2.31	$ 2,156.76	$ 0.42	$ 392.14	$ 7.41	$ 6,927.79
	2x6 Blocking at 24" o.c with Joist Hangars	6,640	sqft	$ 2.76	$ 18,343.00	$ 1.49	$ 9,877.00	$ 0.26	$ 1,693.20	$ 4.51	$ 29,913.20
	CMST12 Nailed to Continuous 3x6	890	lnft					$ 0.96	$ 854.40	$ 16.96	$ 15,094.40
Roofing System											
	Remove Roofing System Down to Plywood Deck	43,450	sqft	$ 4.04	$ 175,429.38	$ 0.21	$ 9,233.13	$ 0.26	$ 11,079.75	$ 4.51	$ 195,742.25
	Remove Roof Insulation System in Trusses	41,000	sqft	$ 1.19	$ 48,687.50	$ 0.06	$ 2,562.50	$ 0.08	$ 3,075.00	$ 1.33	$ 54,325.00
	New Membrane Roofing System with R-38 Rigid Insulation, Flashing and Trim and Downspout Roof Drainage System	43,450	sqft	$ 8.78	$ 381,273.75	$ 10.73	$ 466,001.25	$ 1.17	$ 50,836.50	$ 20.67	$ 898,111.50
Interior Wall/Door/Casework/Specialties Systems											
	Remove and Reinstall Casework at Plywood Sheathing Installation at Walls	1	set	$ 46,750.00	$ 46,750.00	$ 38,250.00	$ 38,250.00	$ 5,100.00	$ 5,100.00	$ 90,100.00	$ 90,100.00
	Remove and Reinstall New Ceiling Systems at Mezzanine Plywood Sheathing Installation	0	sqft	$ 3.30	$ -	$ 2.70	$ -	$ 0.36	$ -	$ 6.36	$ -

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
	Remove and Reinstall Floor Finish Systems-Allow 100% of the Floor Area	41,000	sqft	$ 3.01	$ 123,287.00	$ 1.84	$ 75,563.00	$ 0.29	$ 11,931.00	$ 5.14	$ 210,781.00
	Remove and Reinstall Wall Finish Systems-Allow 100% of the Floor Area	41,000	sqft	$ 2.79	$ 114,390.00	$ 1.71	$ 70,110.00	$ 0.27	$ 11,070.00	$ 4.77	$ 195,570.00
	Remove Plaster Ceiling and Reinstall New ACT Ceiling Systems - Allow 100% of the Floor Area	41,000	sqft	$ 4.22	$ 172,856.00	$ 2.58	$ 105,944.00	$ 0.41	$ 16,728.00	$ 7.21	$ 295,528.00
Subtotal of the Direct Cost of Construction				**Camelot Elementary School Main Building**							**$ 2,225,038**

PD PRODIMS

Non-Structural Costs

Name:	Wa State School Seismic Safety Assessment Phase 2	Areas	sqft
Second Name:	Camelot Elementary School Main Building	Building Area	41,000
Location:	Auburn, WA		
Design Phase:	ROM Cost Estimates		
Date of Estimate:	February 11, 2021		
Date of Revision:	April 9, 2021/June 8, 2021		
Month of Cost Basis:	1Q, 2021	Total Areas	41,000

520 Kirkland Way, Suite 301
Kirkland, WA 98033
Phone: 425-828-0500 Fax: 425-828-0700
www.prodims.com

Camelot Elementary School Main Building

Construction Cost Estimate

Subtotal Direct Cost From the Estimate Detail Below $ 1,112,519

	Percentage of Previous Subtotal	Amount	Running Subtotal
Scope Contingency	10.0%	$ 111,252	$ 1,223,771
General Conditions	10.0%	$ 111,252	$ 1,335,023
Home Office Overhead	5.0%	$ 55,626	$ 1,390,649
Profit	6.0%	$ 66,751	$ 1,457,400
Escalation Included-Costs in 4Q, 2021 Dollars	12.4%	$ 180,135	$ 1,637,535
Washington State Sales Tax - Included in Soft Costs			

Total Markups Applied to the Direct Cost 47.19%
Markups are multiplied on each subtotal- They are not multiplied from the direct cost

		$/sqft
TOTAL ESTIMATED CONSTRUCTION COST--	**$ 1,637,535**	**$ 39.94**
-20% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --	**$ 1,310,028**	**$ 31.95**
+50% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --	**$ 2,456,302**	**$ 59.91**

Please see the Master Summary for Assumptions and Qualifications for ROM Cost Estimates

Direct Cost of Construction

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
	2- Non- Structural Demo/Restoration*										
	M/E/P/FP systems										
	Mechanical/Electrical/Fire Protection Systems *	41,000	sqft	$ 14.08	$ 577,250.54	$ 11.52	$ 472,295.90	$ 1.54	$ 62,972.79	$ 27.13	$ 1,112,519.22
	*Allows 50 percent of existing nonstructural systems M/E/P/FP require upgrades/replacement.										
	Subtotal of the Direct Cost of Construction			**Camelot Elementary School Main Building**							**$ 1,112,519**

Appendix D: Earthquake Performance Assessment Tool (EPAT) Worksheet

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Washington Schools Earthquake Performance Assessment Tool (EPAT)
RESULTS SUMMARY

District Name	Federal Way	**Existing Building Life Safety Risk & Priority for Retrofit or Replacement**
School Name	Camelot Elementary School	
Building Name	Main Building	High

Building Data

HAZUS Building Type	W2	Wood, Commercial & Industrial (>5,000 SF)
Year Built	1964	These parameters determine the capacity of the existing building to withstand earthquake forces.
Building Design Code	<1973 UBC	
Existing Building Code Level	Pre	
Geographic Area	Puget Sound	
Severe Vertical Irregularity	No	Buildings with irregularities have greater earthquake damage than otherwise similar buildings that are regular.
Moderate Vertical Irregularity	No	
Plan Irregularity	Yes	

Seismic Data

Earthquake Ground Shaking Hazard Level	High	Frequency and severity of earthquakes at this site
Percentile S_s Among WA K-12 Campuses	68%	Earthquake ground shaking hazard is higher than 68% of WA campuses.
Site Class (Soil or Rock Type)	C	Very Dense Soil and Soft Rock
Liquefaction Potential	Very Low	Liquefaction increases the risk of major damage to a building
Combined Earthquake Hazard Level	High	Earthquake ground shaking and liquefaction potential

Severe Earthquake Event (Design Basis Earthquake Ground Motion)[1]

Building State	**Building Damage Estimate[2]**	**Probability Building is not Repairable[3]**	**Life Safety[4] Risk Level**	**Most Likely Post-Earthquake Tagging[5]**
Existing Building	61%	57%	High	Red
Life Safety Retrofit Building	12%	5.0%	Very Low	Green
Current Code Building	9.5%	3.0%	Very Low	Green

1. 2/3rds of the 2% in 50 year ground motion
2. Percentage of building replacement value.
3. Probability building is in the Extensive or Complete damage states. For existing buildings, the probability that the building is not economically repairable may be higher: some buildings in the Moderate Damage state are also likely to be demolished.
4. Based on probability of Complete Damage State.
5. Most likely post-earthquake damage state per ATC-20.

Source for the Data Entered into the Tool

Building Evaluated By:	Ben Fisher, Darwin Valenzuale
Person(s) Who Entered Data in EPAT:	Rami Sabra, Reid Middleton
User Overrides of Default Parameters:	Building Design Code Year, Site Class, Liquefaction

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Appendix E: Existing Drawings

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GENERAL NOTES

A. GENERAL

1. The structural drawings shall govern where structural quality and adequacy are concerned.
2. Work all structural drawings, views and notes together. Work these with other drawings.
3. Abbreviations have been used. If in doubt about meaning, consult Architect. His definitions are binding.
4. Titles on drawings and captions on views are descriptive of principal contents. They may contain information that is not reflected in titles and captions.
5. Verify all dimensions for interrelationship and fit before proceeding with work.
6. Specific attention is called to location of grid lines. Use Caution!

B. CODES AND REFERENCES, BASIS FOR DESIGN

1. Uniform Building Code (UBC), 1961. This supplemented by American Concrete Institute "Building Code" (ACI 318-63); American Institute of Steel Construction "Specification for the Design, Fabrication and Erection of Structural Steel for Building" (AISC), 1963; and National Lumber Manufacturers Association "National Design Specification" (NLMA), 1962.
2. Design Live Roof Loads and Lateral Loading:

Classroom units and connecting corridors, roof load:		25 psf
Multi-purpose room and covered play area, roof load:		30 psf
Mechanical platform	:	150 psf
Basic Wind	:	20 psf
Seismic	UBC Zone	3

C. SHOP DRAWINGS

1. Shop drawings and/or detailed construction drawings shall be prepared by the Contractor for all parts of the work, including but not limited to reinforced concrete, structural steel, connection hardware, glued laminated beams and columns, and Trus-Joists. Drawings shall be prepared in accordance with best practice. For this work, employ experienced and skilled persons only. Personnel for this work is subject to approval by Architect.
2. Drawings shall include:
   a. Reinforced concrete. Detailed placing plans, showing the number, size, length, mark, location and bending diagrams for all reinforcing steel and inserts.
   b. Structural steel. Prepare drawings per A.I.S.C. recommended practice.
   c. Connections hardware. Prepare drawings per A.I.S.C., A.I.T.C. and N.L.M.A. recommended practices.
   d. "Trus-Joists". To include stress analysis, details of connections and bearings, members sizes and materials, expected deflections, camber, and bridging location.
   e. In general, shop drawings shall give complete information necessary for the fabrication of the components and proper placement at the site.
   f. Other drawings prepared per accepted standards.
3. Revision of drawings shall be clearly marked. Drawings shall be complete at time of submittal. Related drawings shall be submitted for approval in one package. Shop drawings shall be submitted three weeks prior to their actual need in shop or at job site.
4. The Contractor shall review and approve all drawings before transmittal to Architect. Secure review and/or approval of drawings by Architect before starting work dependent thereon.
5. Review and/or approval by Architect does not relieve Contractor of responsibility for satisfying all requirements, including dimensional fit and the inclusion of all embedded items.

D. PREPARATION OF SITE

(See text below).

E. FOUNDATIONS

1. Assumed soil bearing value = 4000 psf (Max. allowed).
2. Excavation for footings shall not be started until site is completely prepared as outlined in D above.
3. All footings shall be founded on sound undisturbed soil or on fill prepared as given in D above.
4. Keep excavated surfaces free from frost and accumulation of water. Remove all disturbed or softened soil. Excavation shall extend in depth as necessary to obtain the allowable bearing value.
5. Backfill under slab and around foundation walls including trenches for mechanical and electrical installations shall be thoroughly compacted by mechanical tamper in 6" layers. Brace wall if necessary to avoid overstressing or displacing it.
6. Architect will review foundation during site preparation, during excavation for footings, when it is exposed and during backfilling.

F. CONCRETE MATERIALS

1. Portland cement, aggregates and water: Refer to U.B.C.
2. Additives: Sika Plastiment #2, minimum of 2 fl. oz. per sack of cement.
3. Strength: Minimum compressive strength of 3000 psi at 28 days.
4. Maximum slump: 3" for slab and footings; 4" for walls and pedestals.
5. Submit mix designs for approval by Architect. Submit two weeks prior to concreting.

G. CONCRETE PLACEMENT AND DETAILS

1. For mixing and placing concrete refer to U.B.C.
2. Protection for reinforcement shall be per U.B.C. and A.C.I. 318.
3. Corners and intersections: Use corner bars to match all horizontal bars; lap each side 1'-6" min.
4. Bar splices: 24 diam. min.; none less than 12".
5. Hold bars firmly in correct position. Use of nails to space reinforcement from forms is not allowed.

H. REINFORCING AND STRUCTURAL STEEL MATERIALS

1. Reinforcing steel: Intermediate grade ASTM A-15; deformed per ASTM A-305.
2. Structural shapes and plates: ASTM A36.
3. Bolts and nuts: ASTM A 307.
4. K-web: Made from wire, ASTM A82, Longitudinal wires 9 gauge.
5. Welding by welders certified per AWS recommendations. Electrodes per AWS recommendations. No welds less than 3/16" size.

I. REINFORCED HOLLOW CONCRETE MASONRY UNITS

1. All block shall be ASTM C90, grade A, autoclaved, with a maximum moisture of 20% of total absorbtion. Compressive strength f_m' (based on net area) shall be 1200 psi.
2. Mortar: UBC type A, minimum cube strength = 2000 psi at 28 days.
3. Grout: Per UBC. Minimum cube strength = 2000 psi at 28 days.
4. Cells with reinforcement and bond beams shall be filled completely with grout.
5. Lap reinforcement 36 diameters.

J. LUMBER AND PLYWOOD

1. Lumber: Douglas Fir, Coast Region
   Stress grade:
   Light framing (studs, plates, blocking) - - - - - - - - 1500f Industrial L.F.
   Joists -Construction J. & P.
   Columns -Construction P. & T.
   Decking - Commercial Dex
   All Lumber S4S
2. Plywood:
   a. Roof and exterior walls: Douglas Fir, Grade C-C exterior.
   b. Interior walls: Douglas Fir, Structural-interior C-D.
   All plywood to have DFPA (APA) stamp of quality control.
3. Moisture content and finish: See specifications.

K. GLUED - LAMINATED TIMBER (COLUMNS AND BEAMS)

1. Material: Douglas Fir, Coast Region. Adhesive for dry condition of service. Stress grade of product: f = 2200 psi in bending, compression perpendicular to grain = 385 psi.
2. Fabrication shall be by firm approved by Architect. Manufacture and quality control shall be in conformance with Commercial Standard CS 253-63. Products shall bear A.I.T.C. quality control stamp.
3. Appearance grade: A.I.T.C. Industrial grade. Pieces shall be individually wrapped.
4. Dimensions shown on drawings are actual size.
5. Certain beams are cambered. Where camber is specified, it shall be parabolic. Camber given on drawings is maximum camber at center-line of beam.
6. Ends of beams shall have a coat of end sealer applied by manufacturer; column ends shall be dipped for 3 minutes minimum in 5% pentachlorophenol solution prior to applying end sealer.

L. TRUS-JOISTS

1. Manufactured by Trus-Dek Corporation.
2. Materials, Design and Fabrication: As described in International Conference of Building Officials Report No. 1694.2, 1 November 1963.
3. Design Loads:
   (a) Classroom units: 25 psf live load and 15 psf dead load.
   (b) Play area and M.P. room: 30 psf live load and 15 psf dead load.
   (c) Dead loads given include weight of Trus-Joists.
4. Depths of Trus-Joists given are out-to-out, true and full.

M. CONNECTION HARDWARE

1. Connection hardware (called "Simpson") specified on drawings is manufactured by Simpson Company of San Leandro, California.
2. Hardware manufactured by other companies may be substituted provided the hardware is of equal strength, provides the necessary transfer of forces and is approved by the Architect.
3. Hardware of 16 gauge steel and thinner shall be galvanized.
4. Use nails furnished with hardware.
5. Use washers where bolt heads or nuts bear on wood.
6. Custom hardware: Design per A.I.S.C. and N.L.M.A.

N. FRAMING DETAILS

1. Framing details shall be per U.B.C. requirements.
2. Joints and Splices:
   (a) Splices shall not be allowed in studs and joists.
   (b) Joints in upper and lower member of top plate shall be staggered not less than 4 feet and shall occur at center of studs.
   (c) Foundation plate shall be spliced between studs. Use scab same size as plate. Minimum of 4-16d nails into each end of splices.
3. Blocking and Bridging:
   (a) In stud walls over 8' in height space blocking of same size as studs at 8'. Alternate with 2 x 4 blocking spaced at 8'. Place blocking to coincide with plywood joints.
   (b) All roof joists shall be blocked at supports. Roof joists over 8' in span shall be cross bridged at midspan.
   (c) Trus-Joists shall be bridged with continuous 2 x 6 at intervals shown on drawings. (2x8 in multi-purpose room).
4. Where glue-lam beams are cambered, the camber shall be reflected at the roof line.
5. Nailing
   (a) Studs to top plate - - - - - - - - - - - - - 4-16d toe nails
   (b) Studs to foundation plate- - - - - - - - - - 4-16d toe nails
   (c) In classroom units:
   2x4 blocking between trus-joist to sloped 2x6 - - - - 3-16d between joists.
   2x6 sloped to top member of top plate - - - - - - - - 16d @ 12"
   top member of plate to bottom member - - - - - - - - - 16d @ 12"
   Stagger specified nailing into 2 rows.
   (d) In play area and multi-purpose rooms:
   Top plates and associated blocking are bolted. Nail sufficiently to maintain rigidity and alignment prior to bolting.
   (e) Trus-Joists nailing to plate: Use nails provided with Trus-Joist by manufacturer.
   (f) Other minimum nailing: See Chapter 25 in U.B.C.
   (g) Nailing and framing hardware specified are minimum. Provide adequate nailing to obtain well-connected structures.

O. MISCELLANEOUS

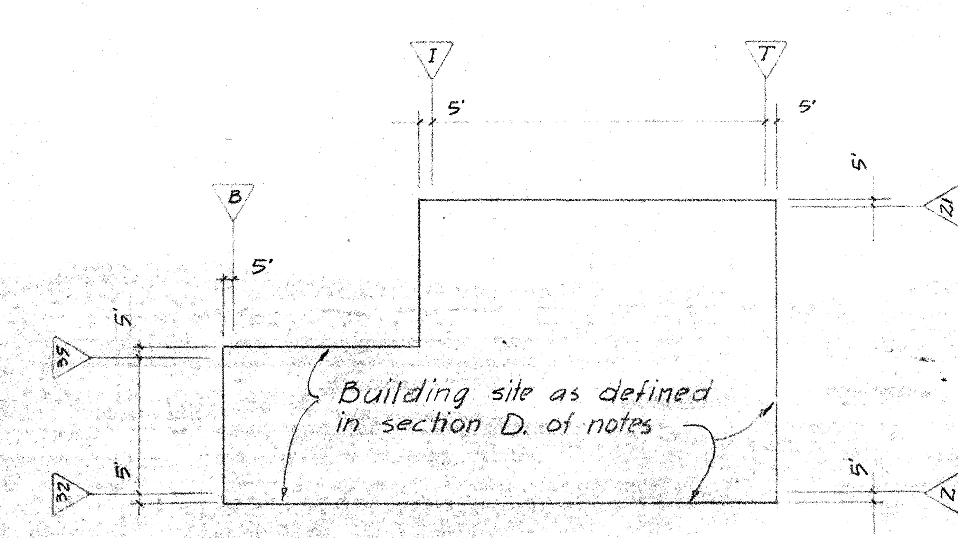
1. Layout is repetitive. Details given are typical, i.e. similarly repetitive.
2. Nails shall not be driven within 6" of the ends of Trus-Joists chords, nor within 3" on either side of a panel joint. Nails which normally would be driven into Trus-Joists within these regions shall be offset to fall outside these regions.

D. PREPARATION OF SITE

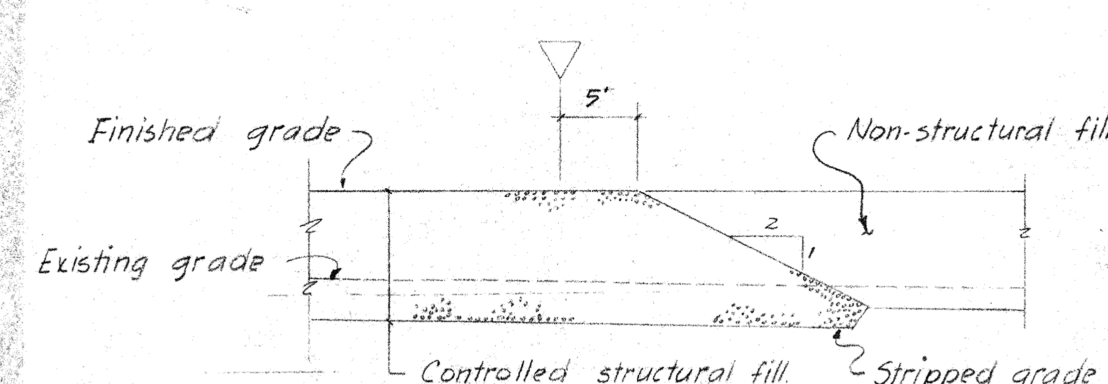
1. These notes apply to the building site proper which is hereby defined as limited at finished grade by a boundary located 5 feet outside buildings with their appurtenances. Refer to definitive plan and section on this drawing.
2. Remove from building area all vegetation, roots, topsoil and fine silty sand exposing gravelly sand which occurs at approximately 3 feet below natural grade.
3. In areas below required finished grade build up with sound compacted fill.
4. Fill shall be: Clean pit run sand and gravel containing no more than five percent material passing a No. 200 mesh sieve. Use approved material only for fill. Material at site is not suitable for fill purposes.
5. Deposit material in 6" layers compacting each layer as necessary to obtain not less than 95% of modified AASHO maximum density.
6. Build up entire area uniformly.
7. Provide means necessary to prevent puddling on entire building site.
8. Entire building site shall be graded prior to excavating for footings.
9. See specifications for testing and inspecting of embankment.

LIST OF STRUCTURAL DRAWINGS

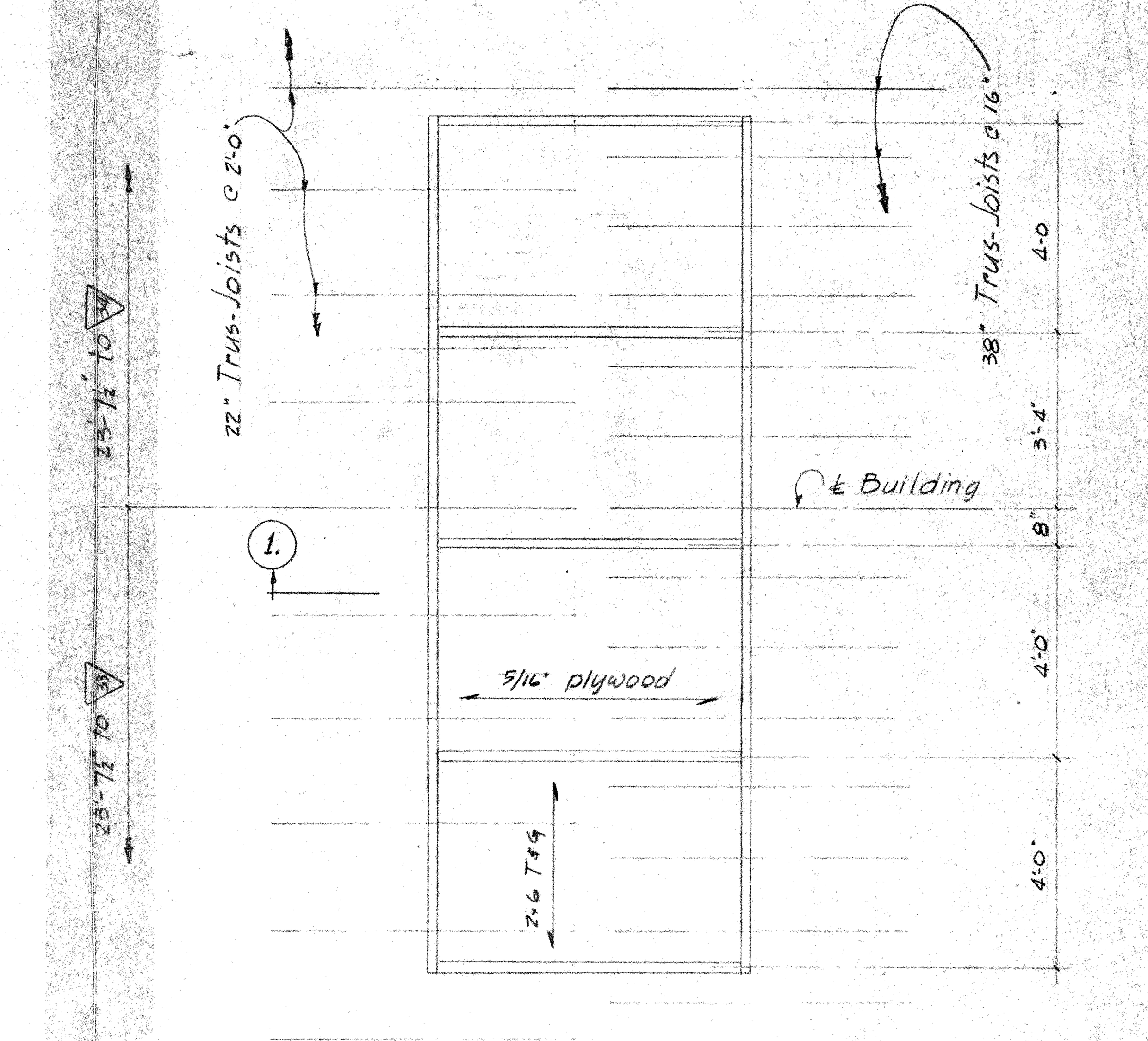
S1- - - - General Notes
S2- - - - Foundation
S3- - - - Roof and Framing Details, Multi-Purpose Room
S4- - - - Framing Details, Multi-Purpose Room
S5- - - - Roof and Framing Details, Classroom Units
S6- - - - Framing Details, Classroom Units
S7- - - - Framing Details, Mechanical Platform
S8- - - - Misc. Details, Classroom Units and Corridors



BUILDING SITE PLAN 1"=100'

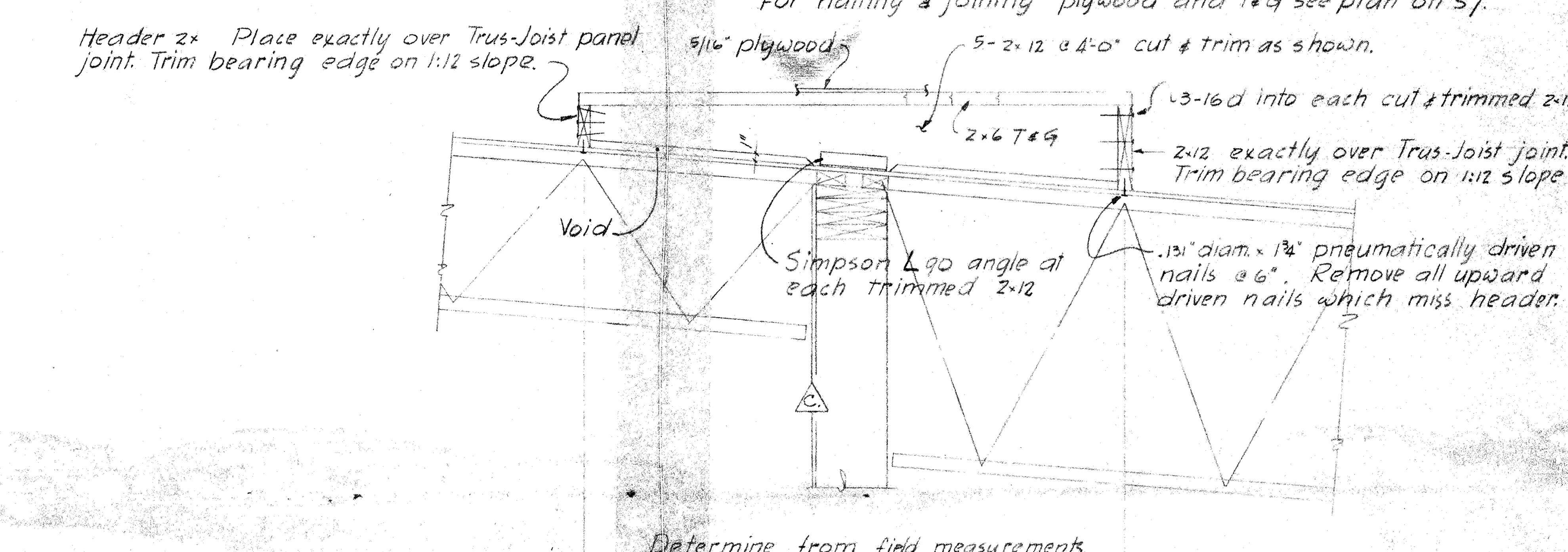


TYPICAL SECTION THROUGH FILL

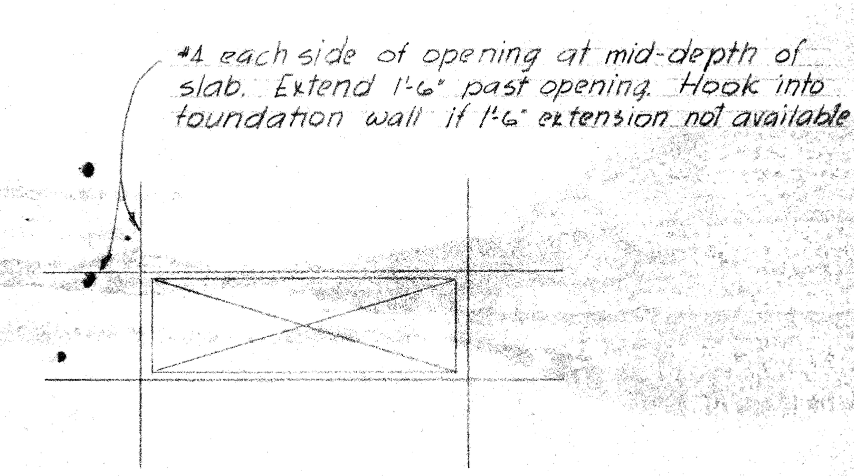


PLAN - MECHANICAL PLATFORM OVER PLAY AREA & MULTI-PURPOSE ROOM 3/8"=1-0

For nailing & joining plywood and T&G see plan on S7.



SECTION 1 3/4"=1-0



PLAN - TYPICAL SLAB REINFORCEMENT AROUND DUCT OPENING - NO SCALE

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1123 PORT OF TACOMA ROAD
TACOMA, WASHINGTON

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GENERAL NOTES

S 1 OF 8

DETAIL A 1/2" = 1'-0"
FOUNDATION PLAN 1/16" = 1'-0"
All floor slabs 5" unreinforced. Elev. = 444.0
See S-1 for reinforcement around duct openings
Lower foundation wall & provide contraction joint between doors as at interior doors. Typical all toilet annexes.
See detail at Pq
see detail A
Adjacent slab casting sequence. One week apart.
Location of columns with respect to I same as on O
Location of columns with respect to T same as on W
contraction joint
℄ footing see sect. 9
℄ footing See sect. 11
℄ footing shown in section 10
Detail
TYPICAL FOOTING FOR 2x10 STUD WALL
SECTION 1 3/4" = 1'-0"
TYPICAL FOOTING FOR 2x8 STUD WALL
SECTION 2 3/4" = 1'-0"
TYPICAL FOOTING FOR 2x6 STUD WALL
SECTION 3 3/4" = 1'-0"
TYPICAL FOOTING FOR 2x4 STUD WALL
SECTION 4 3/4" = 1'-0"
Elev. 444.0
See plan and arch. drwgs.
Interior
Increase to 12" for 1'-3" each side of K2 and L2. In wall stem at K2 and L2 provide 4#3 with 3#3 ties as shown in section 10.
FOOTING ON 2, 4 & 24 FROM I TO M AND P TO S (see also sect. 7 & detail B)
SECTION 5 3/4" = 1'-0"
See arch. drwgs for cap details.
Bond bms.
K-web
Wall reinforcement:
Vertical: 2#4 hooked at top @ 4'-0" in grouted cells. Dowels to match.
Horiz: 2#4 continuous in each bond beam K-web in joints shown
5#4 cont.
#4 @ 12" Alternate hook left & right.
10 COURSES @ 8" = 6'-8"
CMU WALL
SECTION 6 1/2" = 1'-0"
Same elevation as base of adjacent footing
#3 ties @ 12"
3#4 cont.
CORRIDOR FOUND. TIES
SECTION 7 3/4" = 1'-0"
PLAY AREA FOUND. TIE
SECTION 8 3/4" = 1'-0"
3 1/2" square steel col.
Same elev. as adjacent slab.
1'-0" square
6" square
Grout in 6" cell
4#3
3#3 ties
5#4 each way 3" clear bottom
2'-0" square
FOOTING FOR STEEL COLUMNS
SECTION 9 3/4" = 1'-0"
Elev. 444.0
4#5
3#3 ties
2'-6" square
FOOTING FOR COLUMNS OF BEAMS B21 & B22
SECTION 11 3/4" = 1'-0"
2'-6" square
FOOTING FOR SOUTH COLUMNS OF BEAM B2
SECTION 10 3/4" = 1'-0"
1/4" x 5" Elastite
Vapor barrier
EXPANSION JOINT TYPICAL AT FOUNDATION WALL
DETAIL D
Contraction joint = c.j. (Double line in plan)
Partition
3/4" x 2'-0" smooth dowel @ 2'-0". Min. of 2 dowels at each door. Grease & cap projecting end.
CONTRACTION JOINT
SECTION 12 3/4" = 1'-0"
Contraction joint See section 12 for dowels.
TYPICAL SECTION THROUGH INTERIOR DOOR
DETAIL C
Deflect top reinf. bar
Base of plate at elevation of top of wall or pedestal.
TYPICAL COLUMN BASE PLATE 3/4" = 1'-0"
DETAIL E
Rough surface see arch. details
TYPICAL SECTION THROUGH EXTERIOR DOOR
DETAIL B
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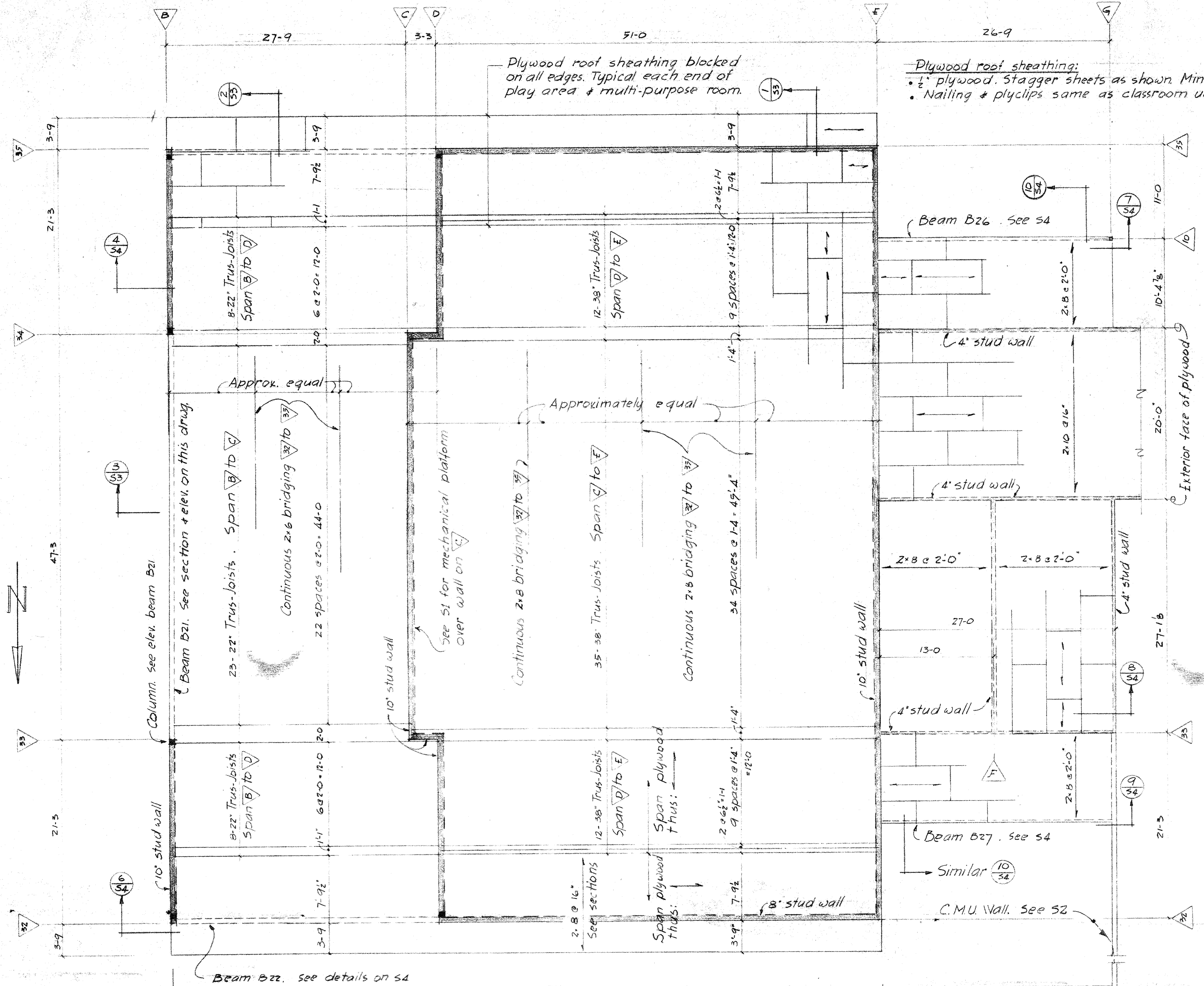
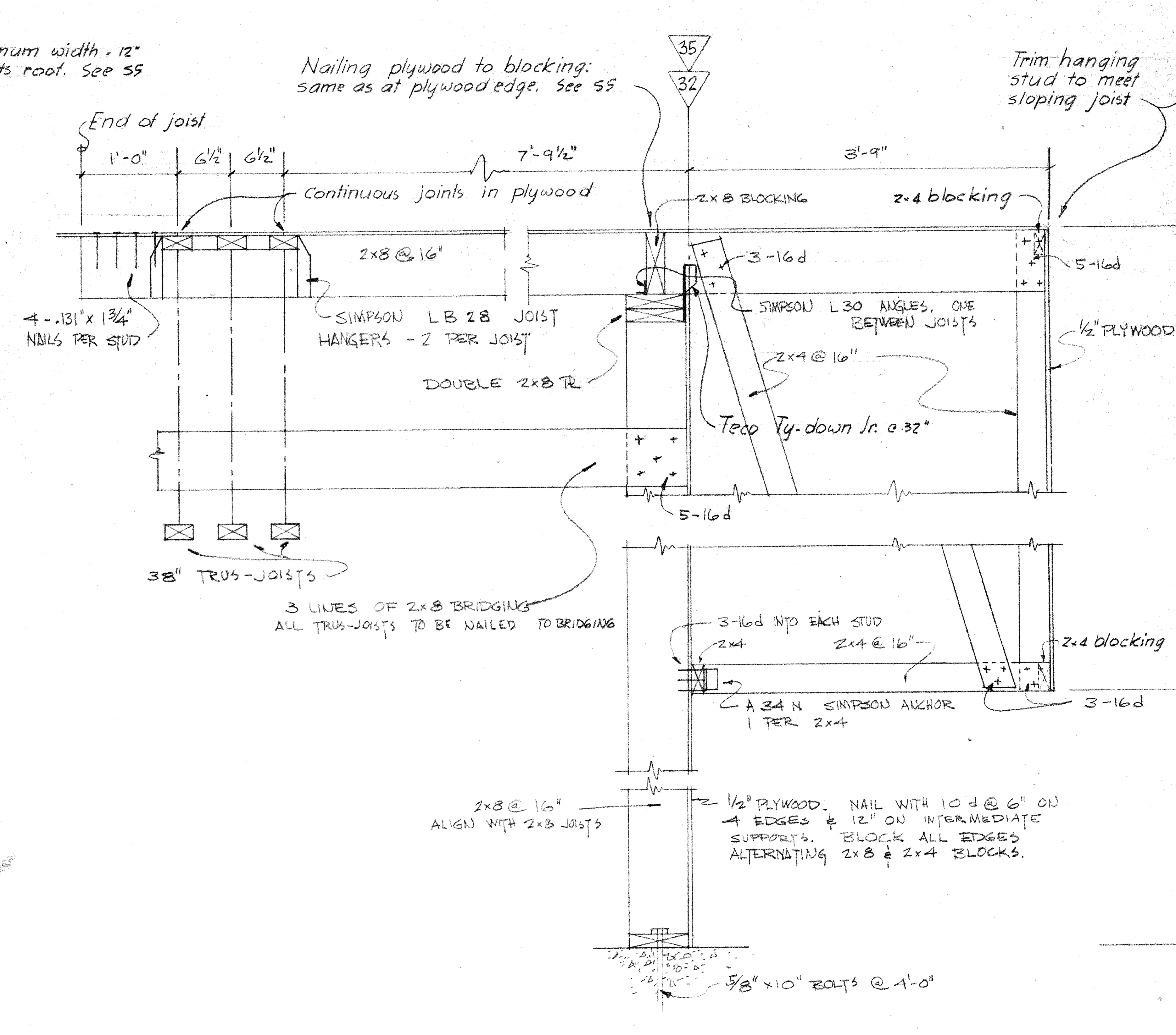
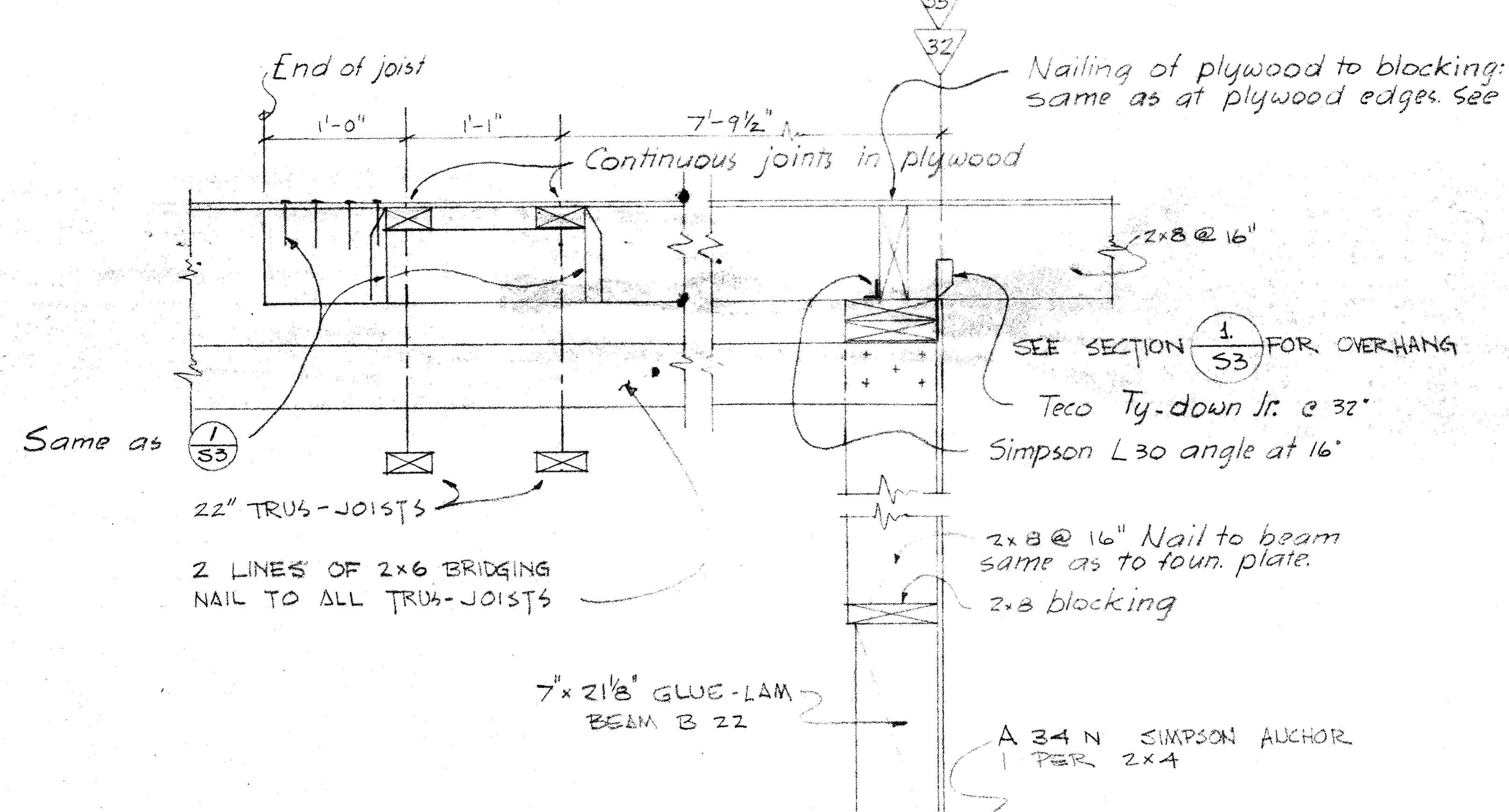
Camelot Elementary School
Federal Way School District No. 210
King County, Washington
FOUNDATION
S 2
OF 8
Engineer's File: B-339



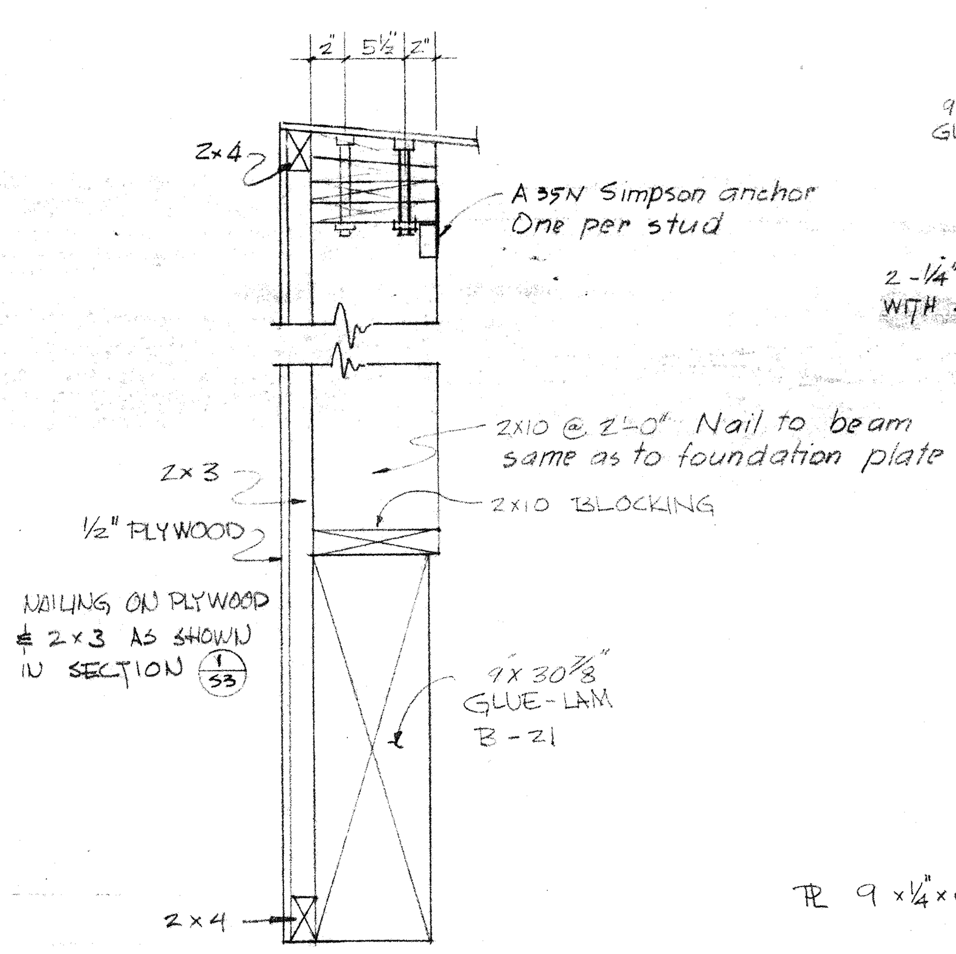
ROOF PLAN 1/8" = 1'-0"



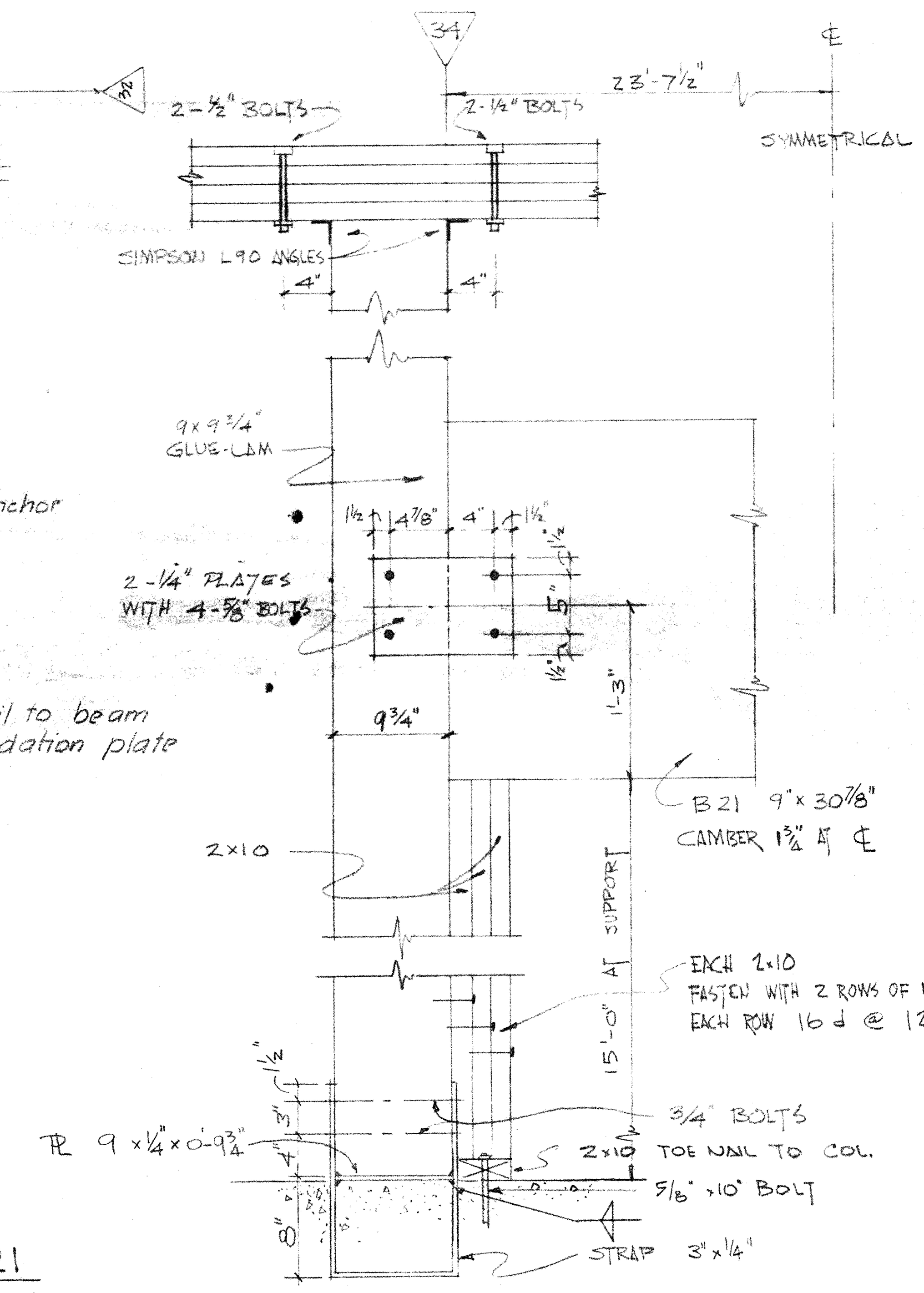
SECTION 1/S3 EXTERIOR WALLS 1" = 1'-0"



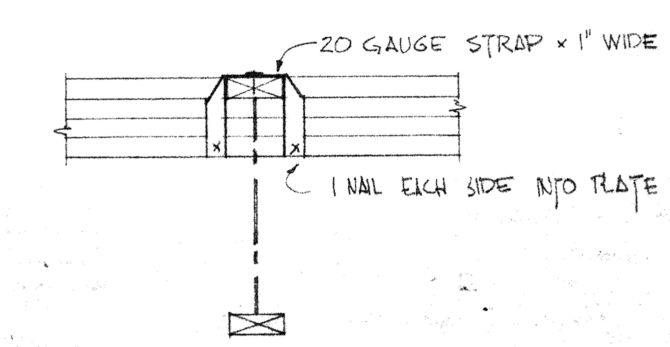
SECTION 2/S3 EXTERIOR WALLS 1" = 1'-0"



SECTION 3/S3 BEAM B 21



ELEVATION — BEAM B21 ON GRID B



ANCHORING TRUS-JOIST AT WALL
TYPICAL ALL TRUS-JOISTS IN MULTI-PURPOSE ROOM & COVERED PLAY AREA

PRINTED DEC 31 1964

REGISTERED ARCHITECT
James Martin Harris
STATE OF WASHINGTON

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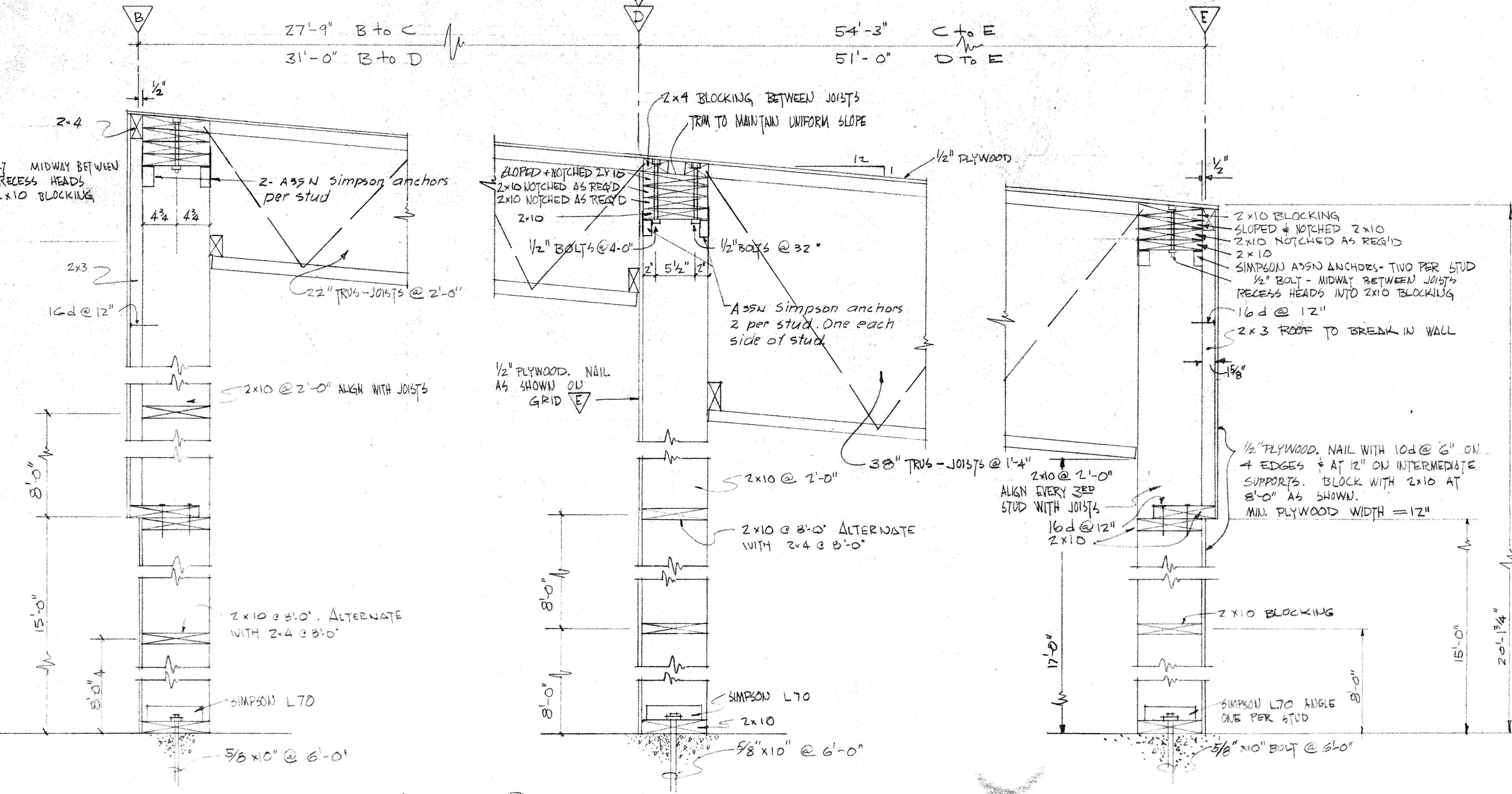
Camelot Elementary School
Federal Way School District No. 210
King County, Washington

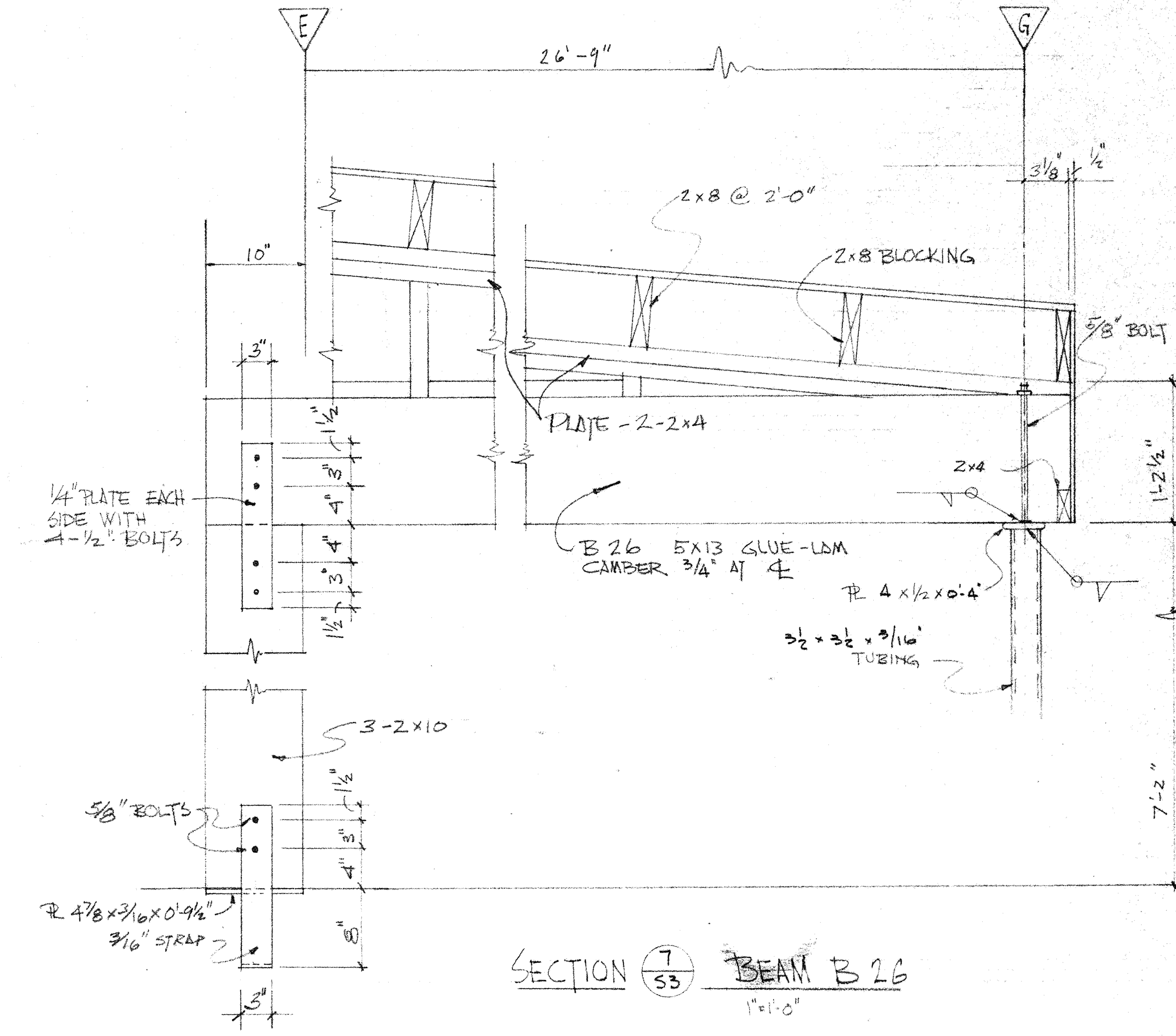
ROOF & FRAMING DETAILS
MULTI-PURPOSE ROOM

S 3
OF 8

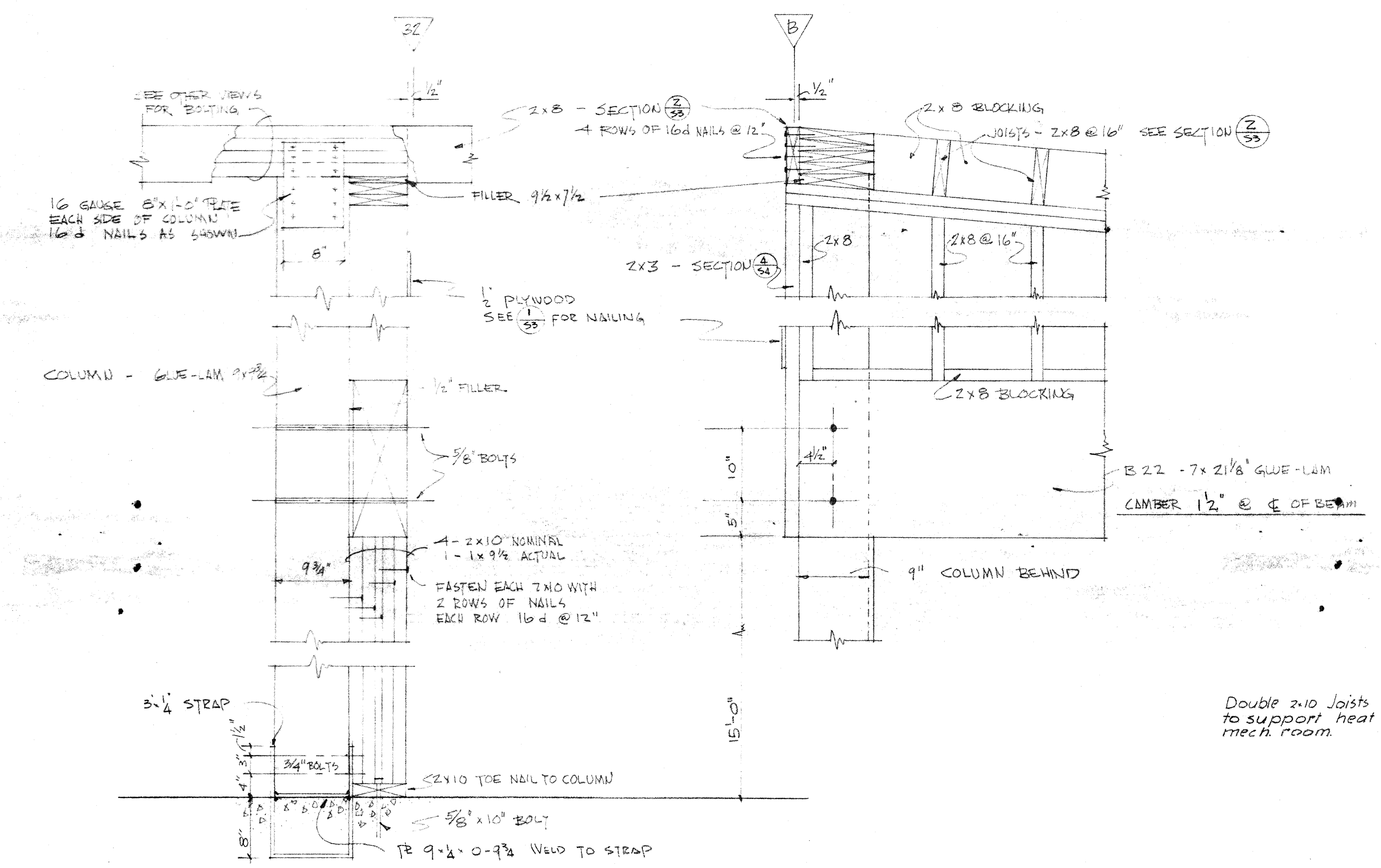
Engineer's file: B-339



SECTION 4/S3 ROOF & WALLS DETAILS 1"=1'-0"



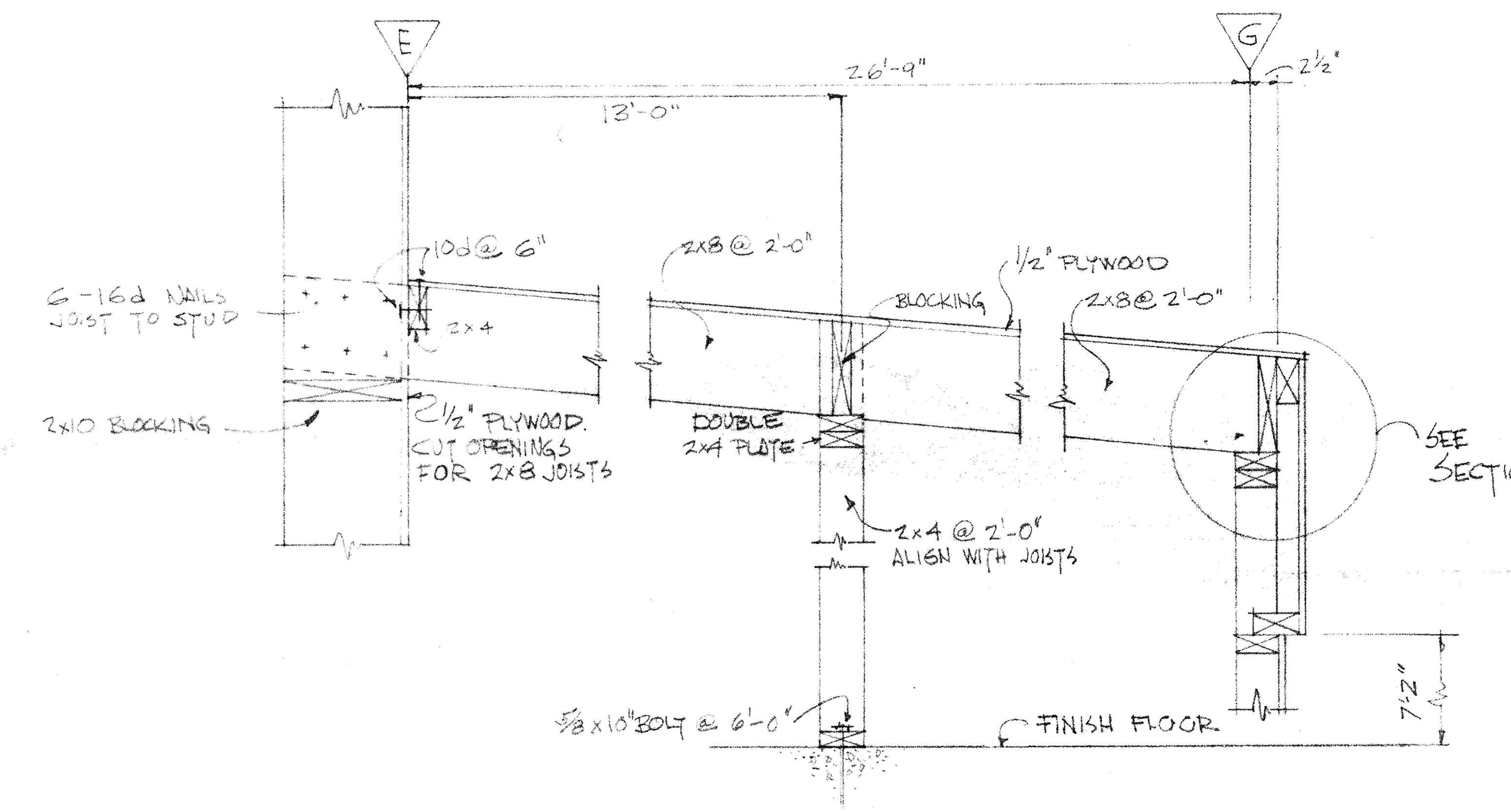
SECTION 7/S3 BEAM B 26
1"=1'-0"



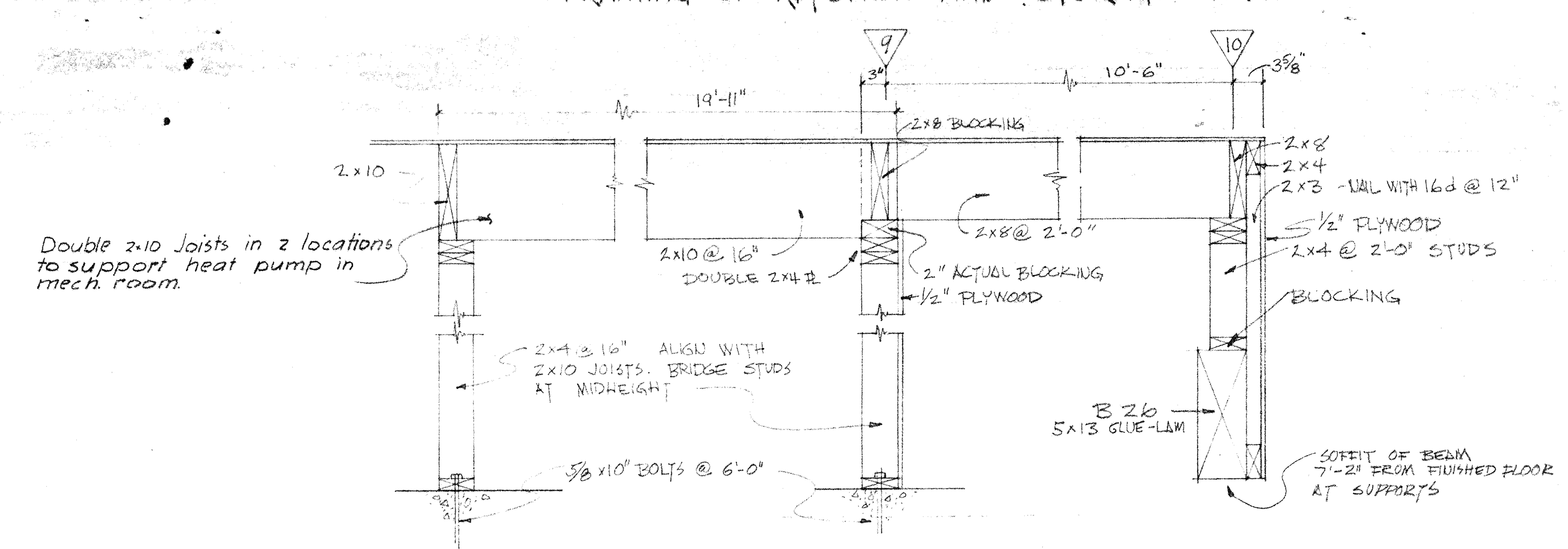
SECTION 5/S3 SECTION 6/S3

BEAM B22 AND CONNECTION DETAILS 1"=1'-0"

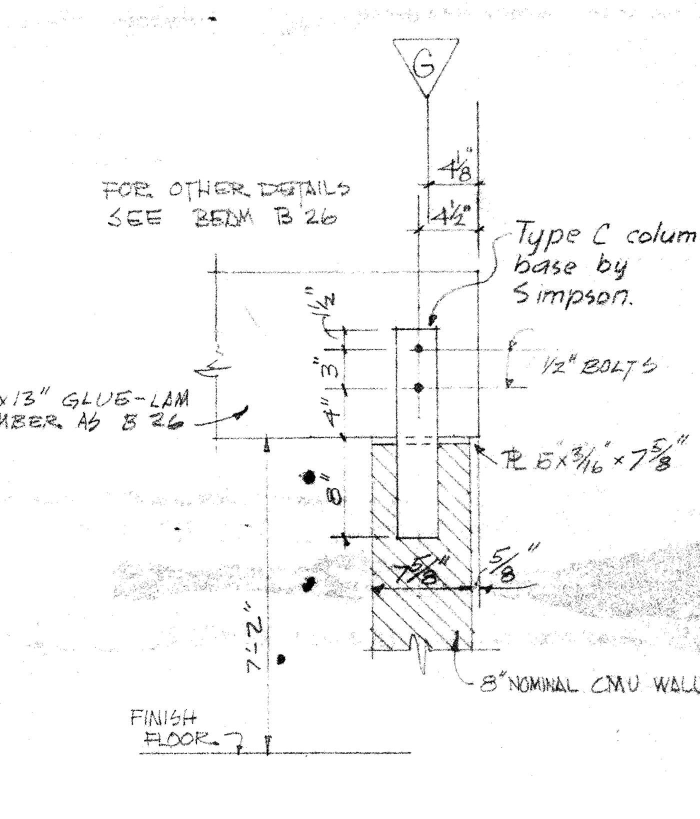
NOTE: COLUMN & BEAM CONNECTIONS AT B35, D32, & D35 SIMILAR TO SHOWN AT B32



SECTION 8/S3 1"=1'-0"
FRAMING OF KITCHEN AND STORAGE AREA



SECTION 10/S3 1"=1'-0"



SECTION 9/S3 BEAM B27

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FRAMING DETAILS

MULTI-PURPOSE ROOM

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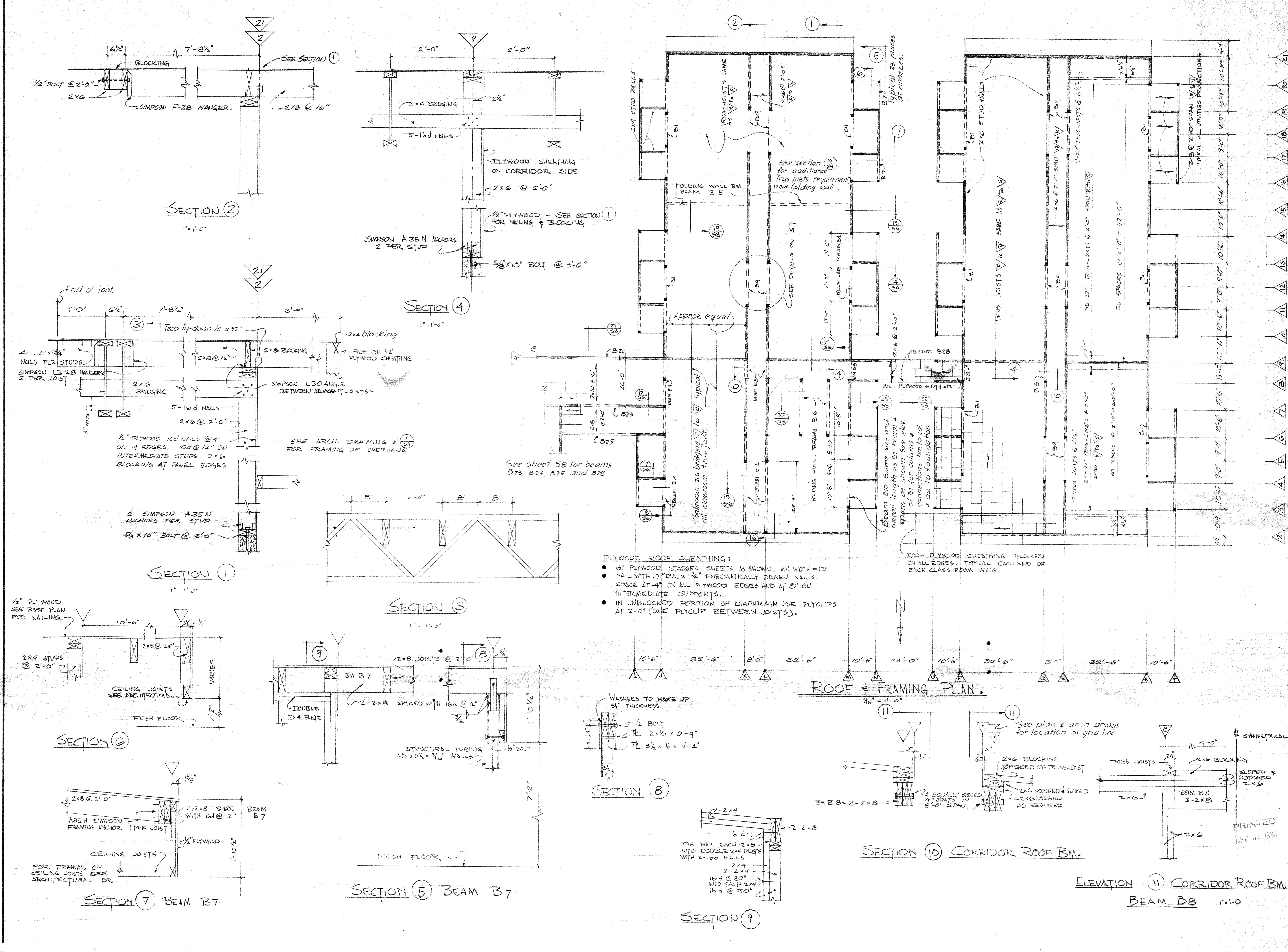

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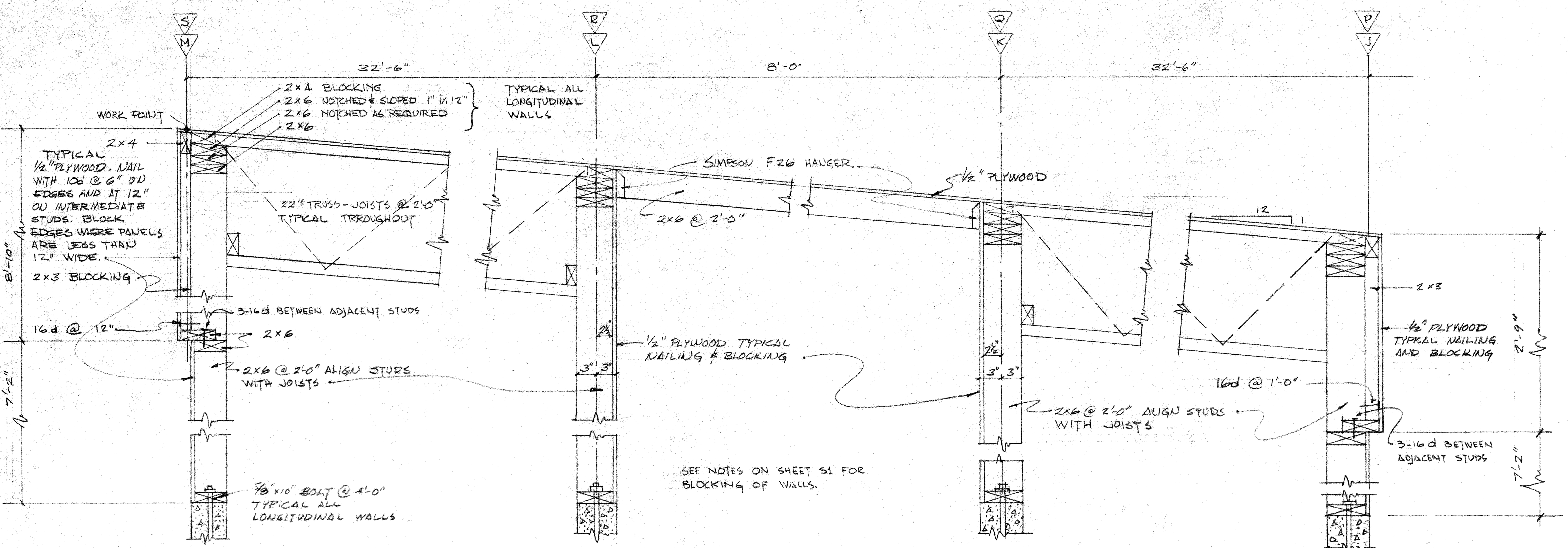
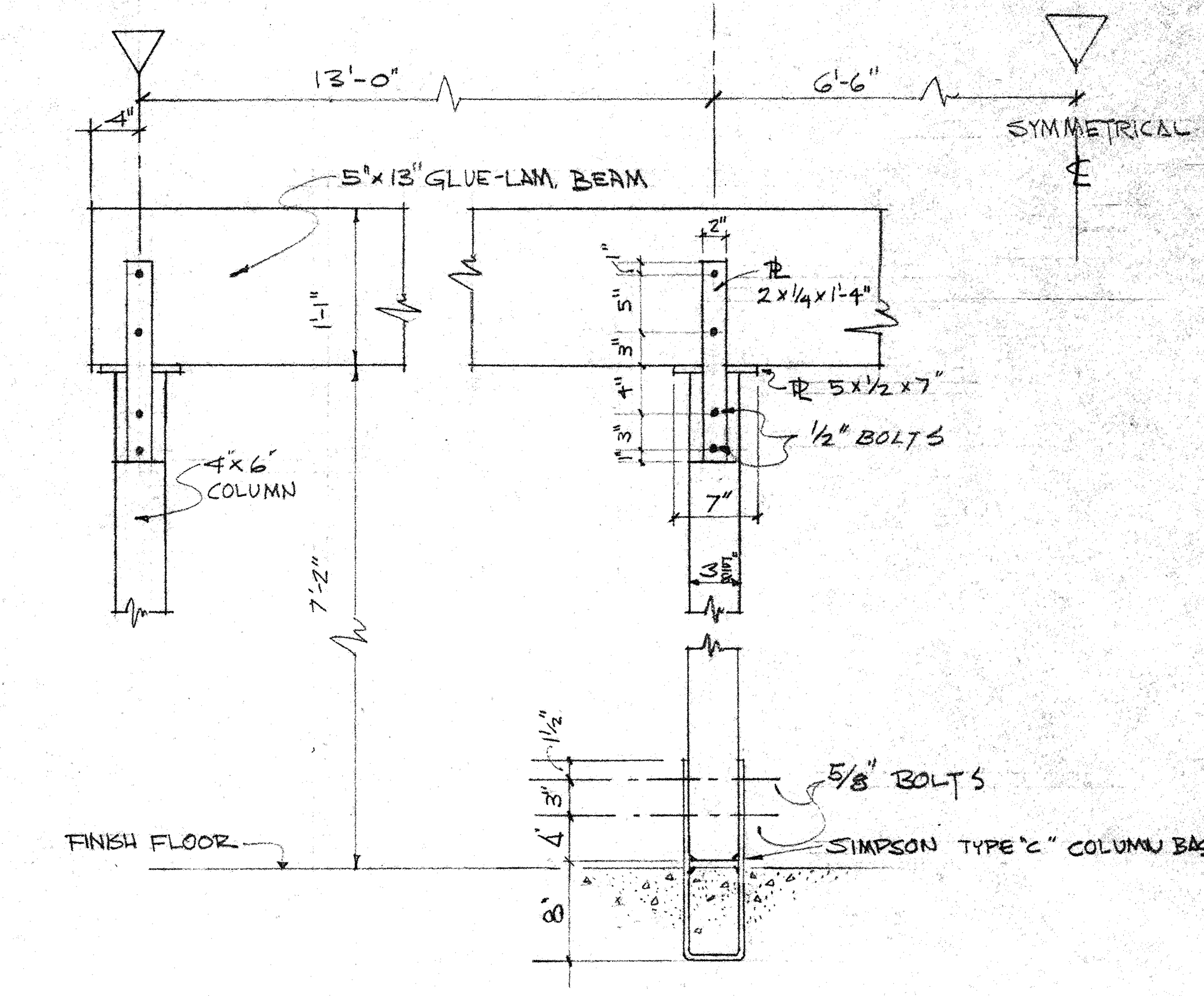
ROOF & FRAMING DETAILS
CLASSROOM UNITS

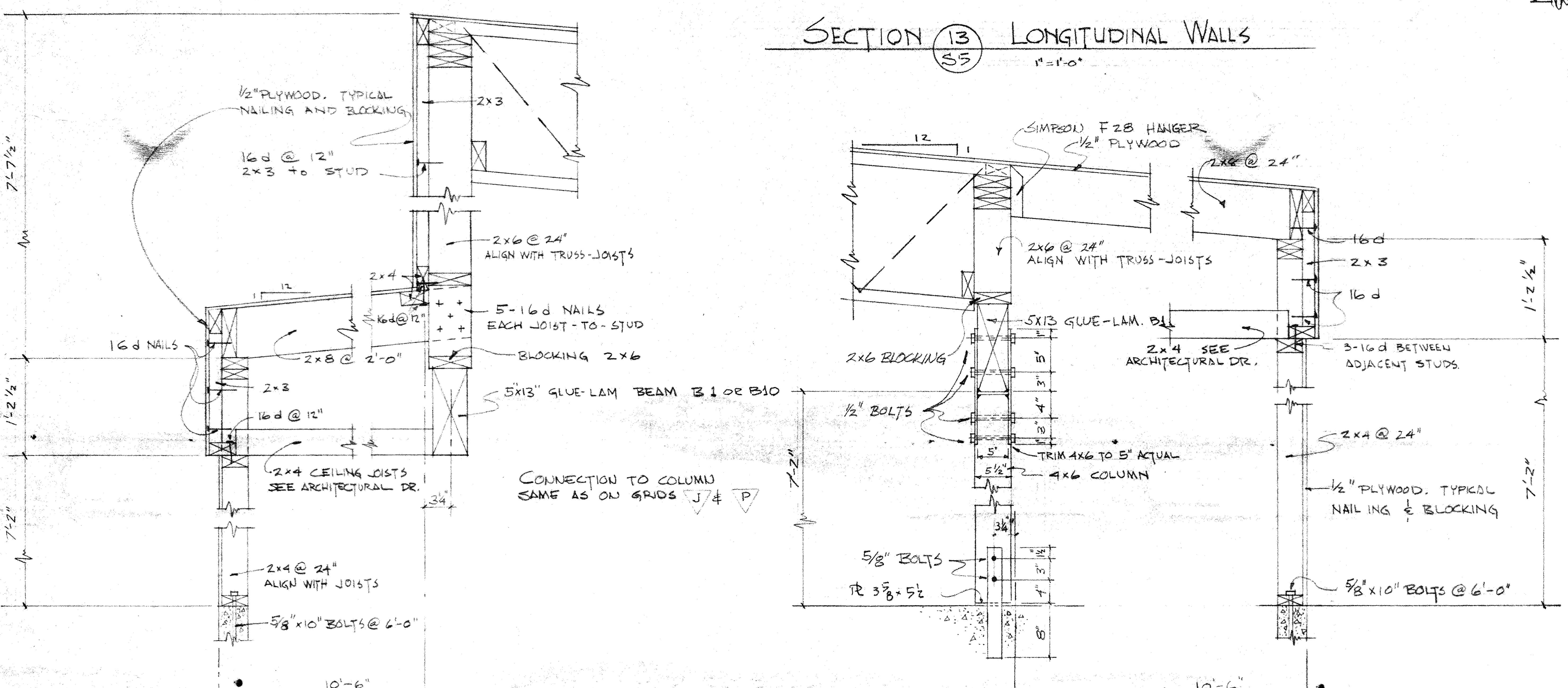
S 5 OF 0



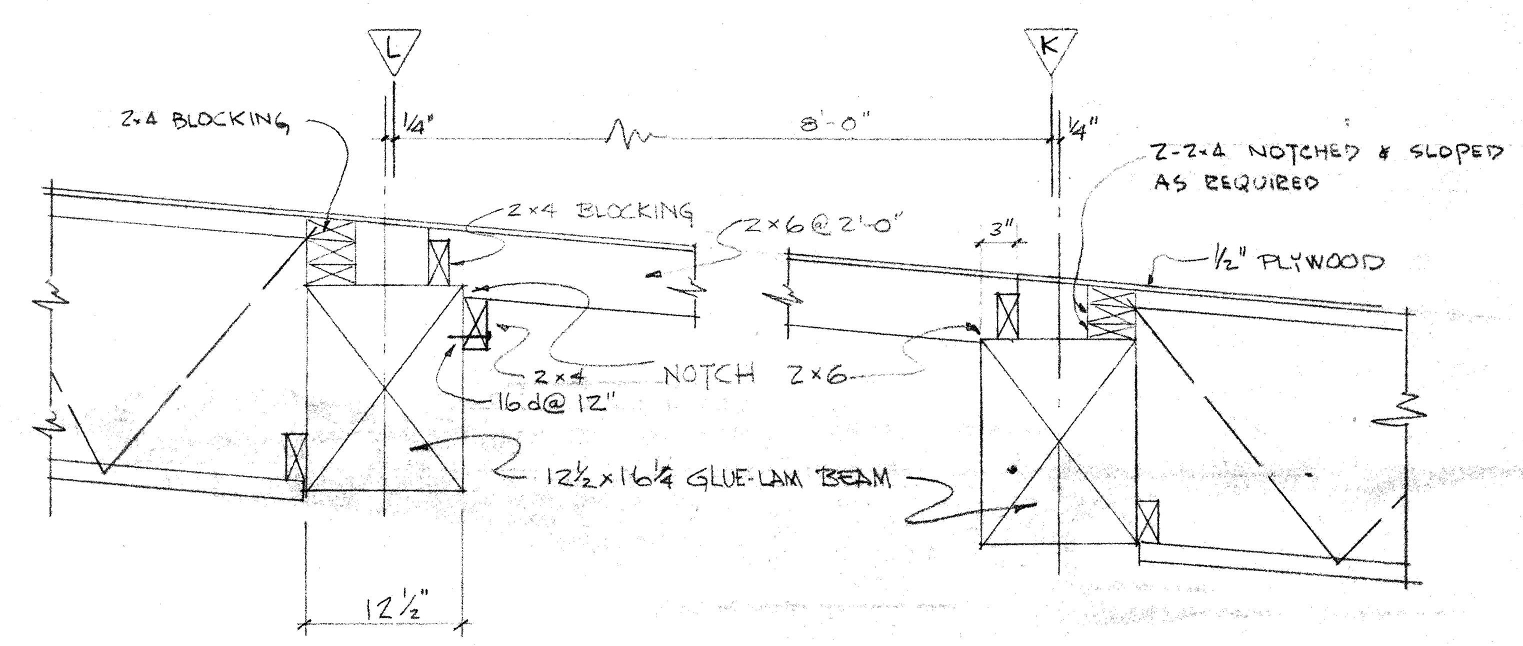
SECTION 13/S5 LONGITUDINAL WALLS
1"=1'-0"



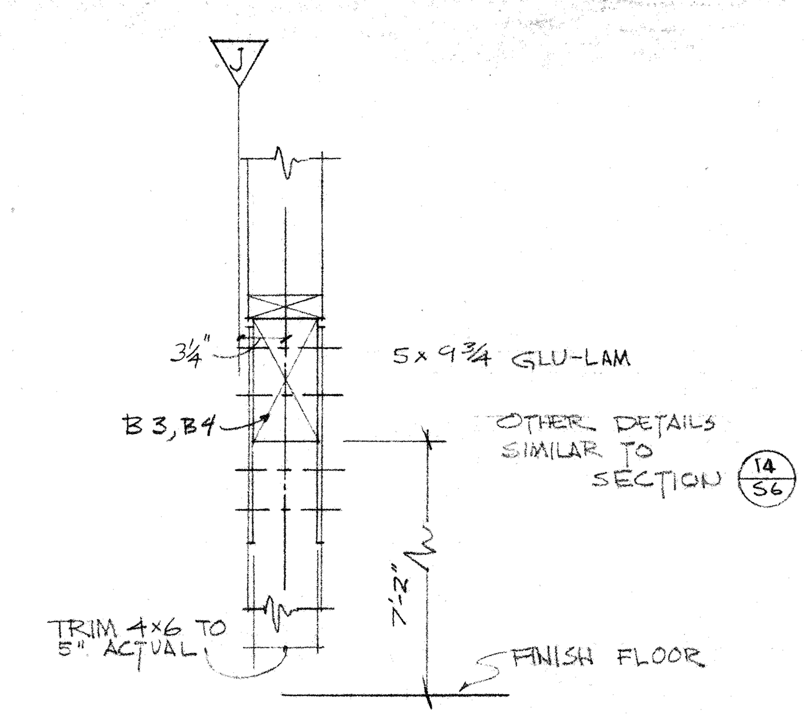
SECTION 12/S5 BEAM B1



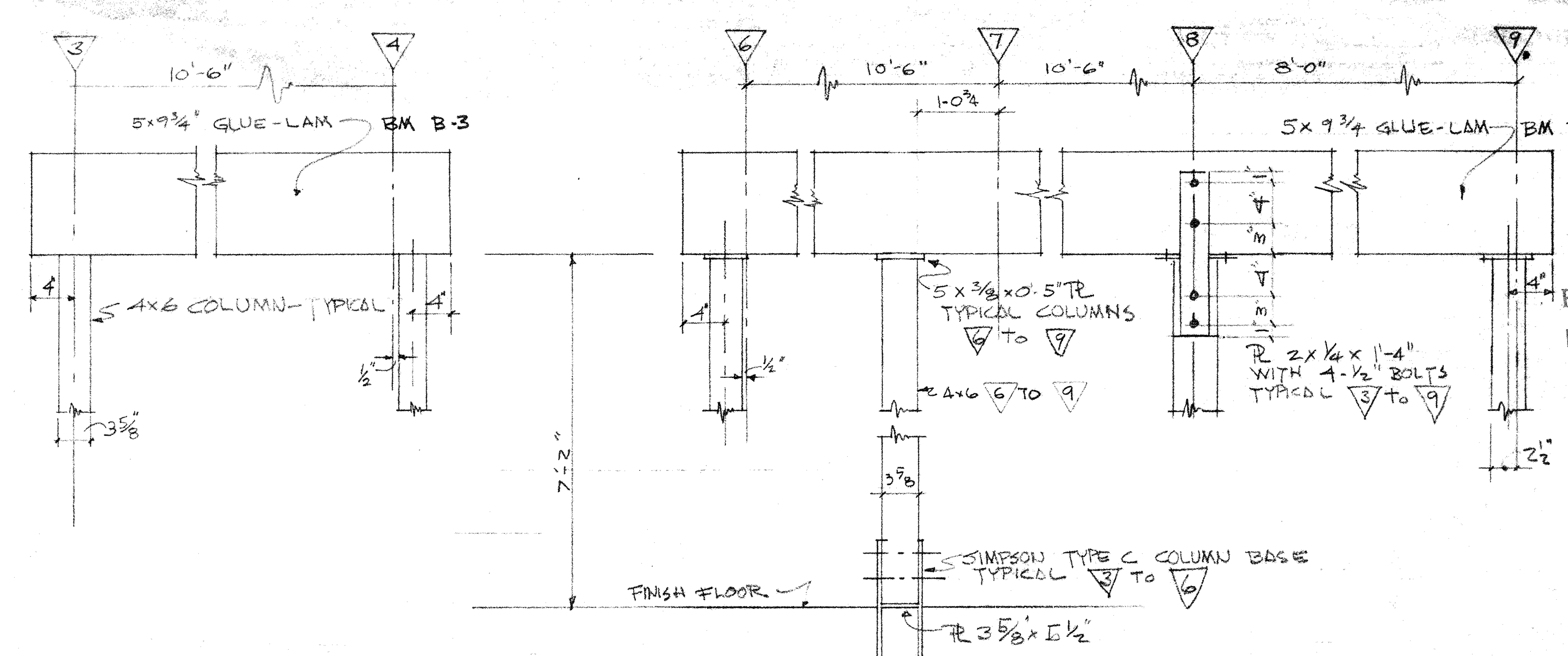
SECTION 14/S5 LONG. WALLS
1"=1'-0"



SECTION 15/S5 BEAM B2
(See also sheet S7)



SECTION 17/S5 BMS. B3 & B4



SECTION 18/S5 BMS. B3 & B4

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FRAMING DETAILS
CLASSROOM UNITS

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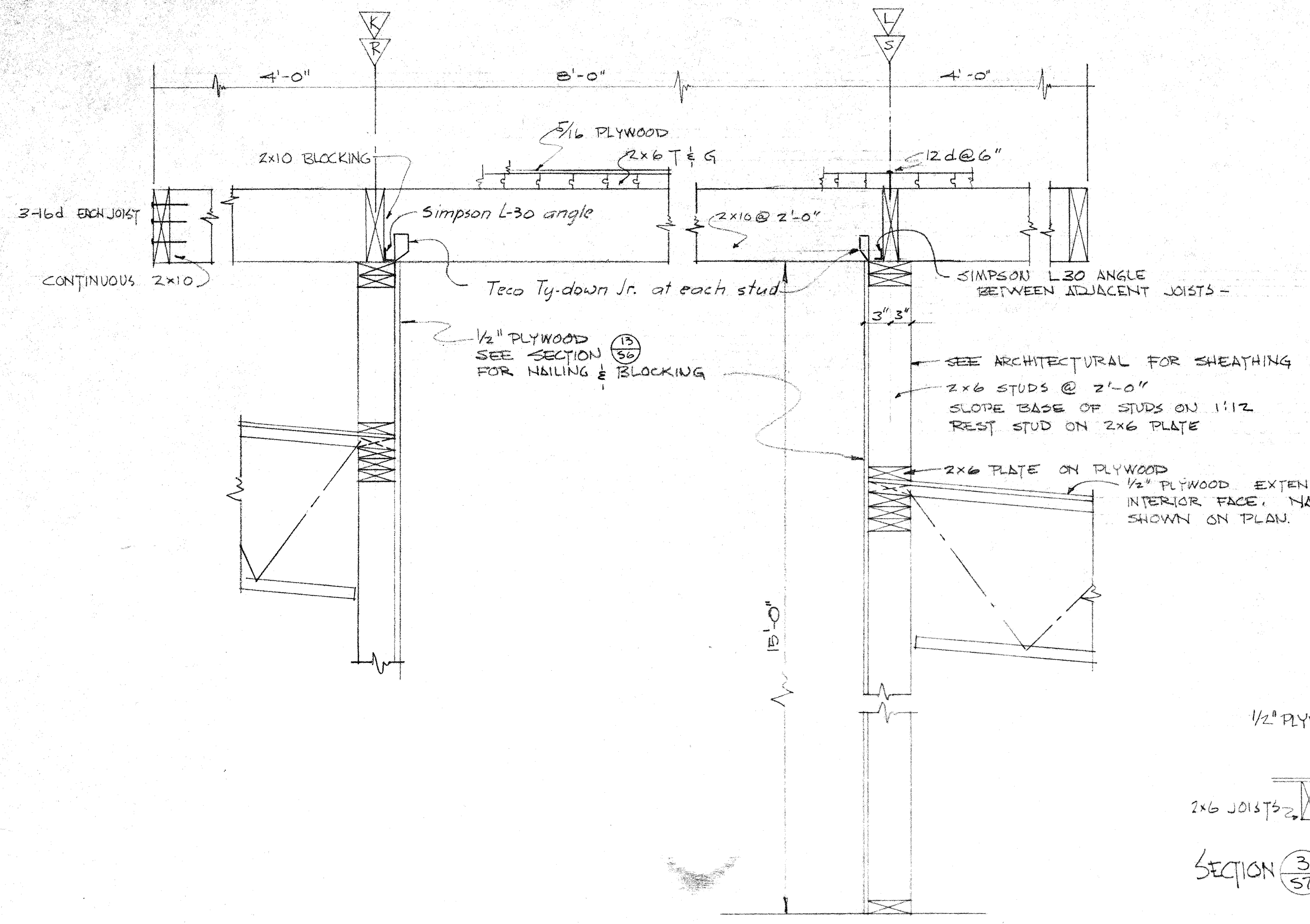
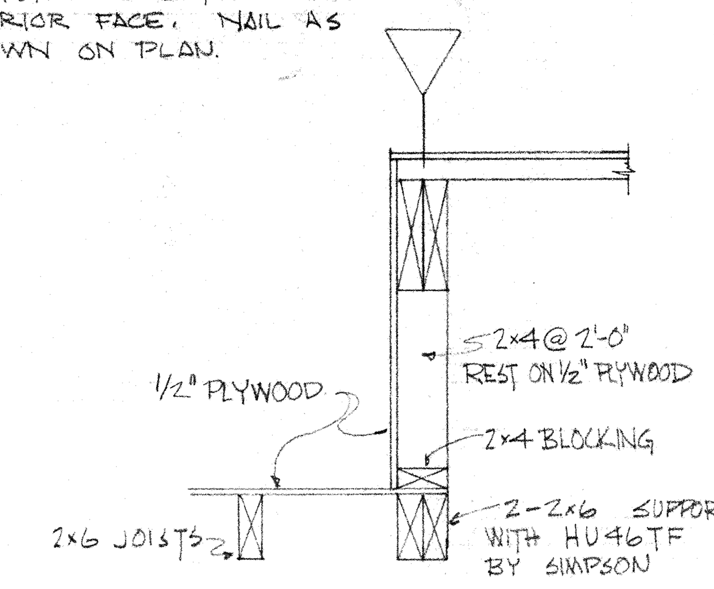
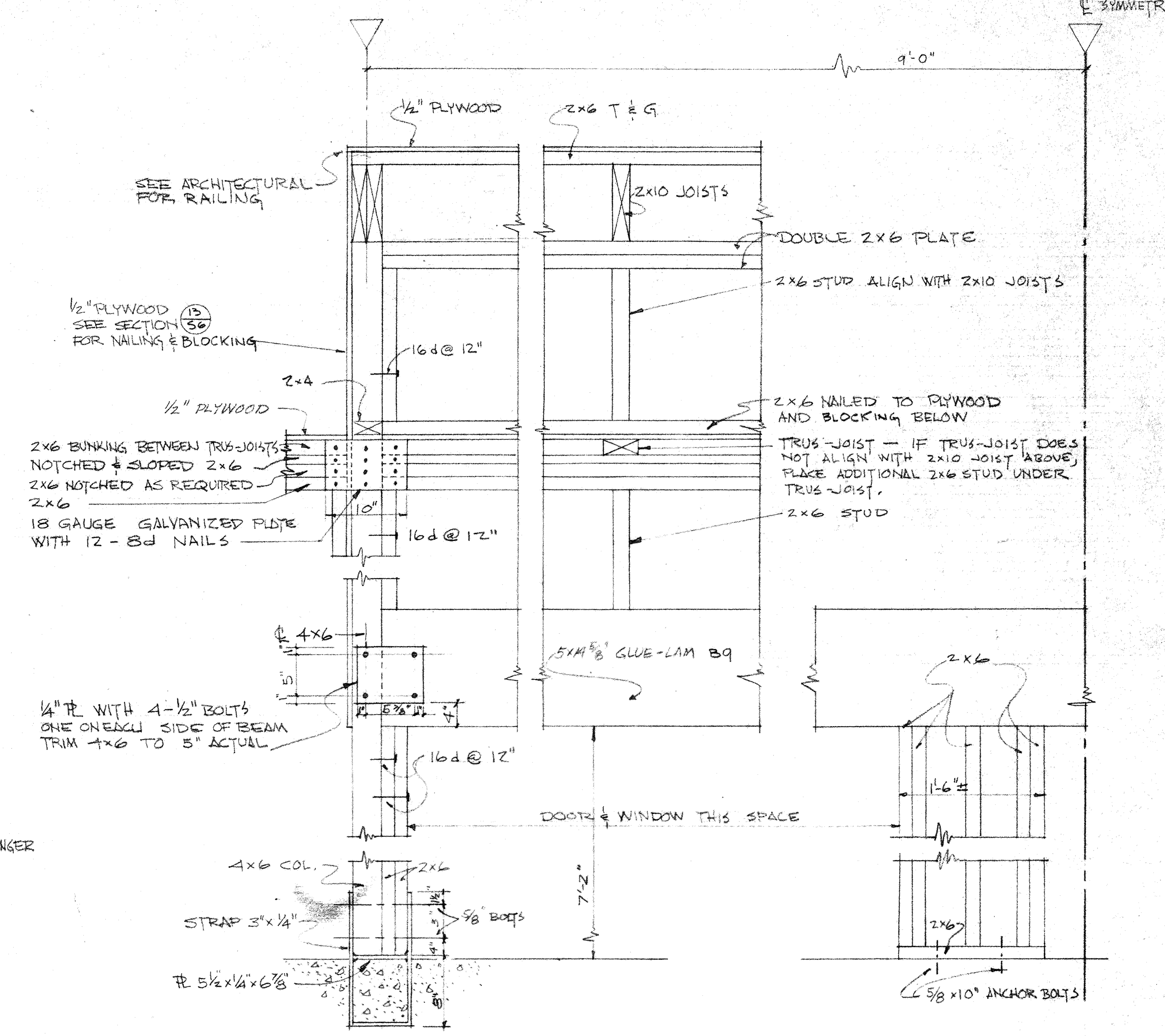


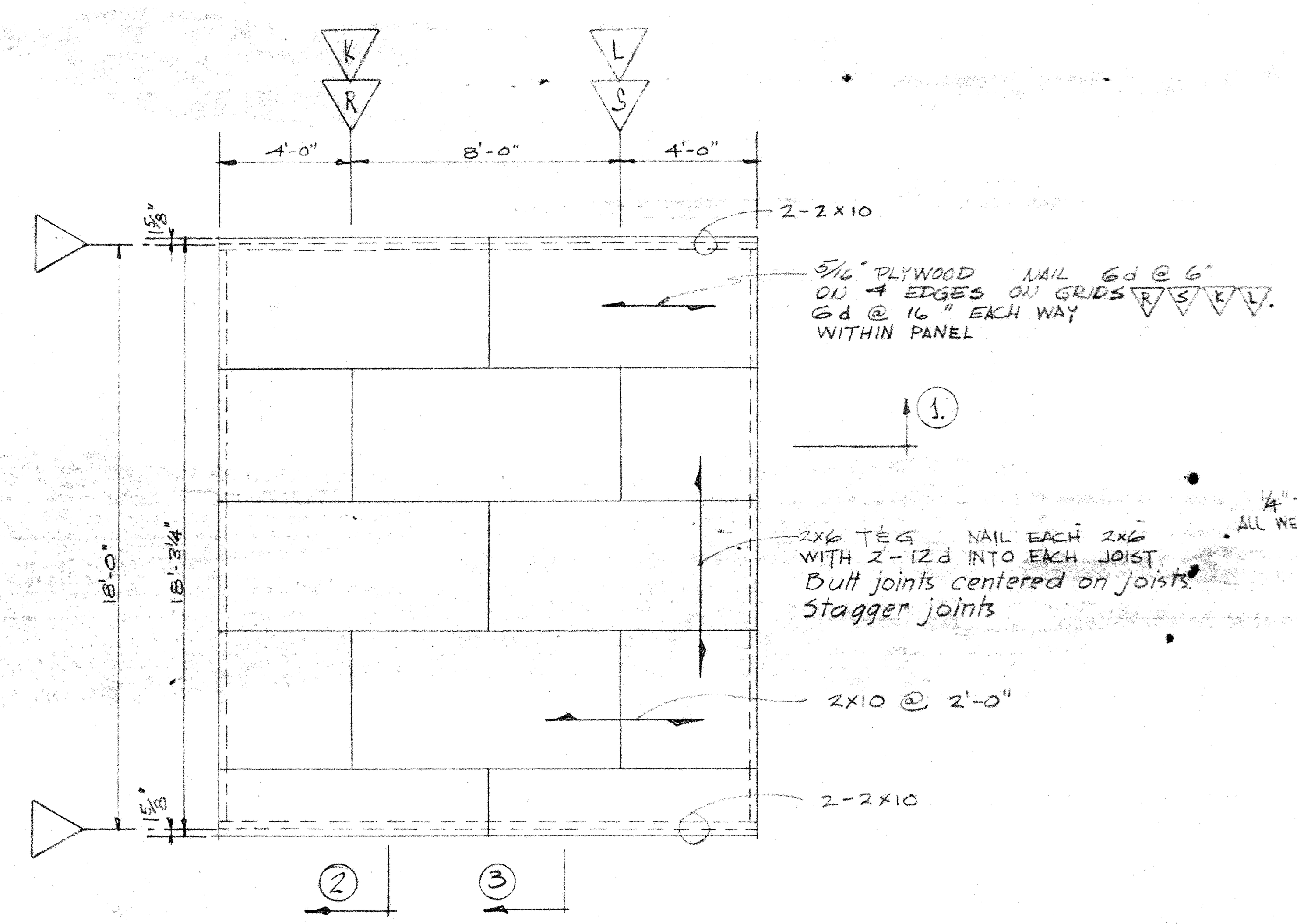
SECTION 1/S7 MECHANICAL SPACE



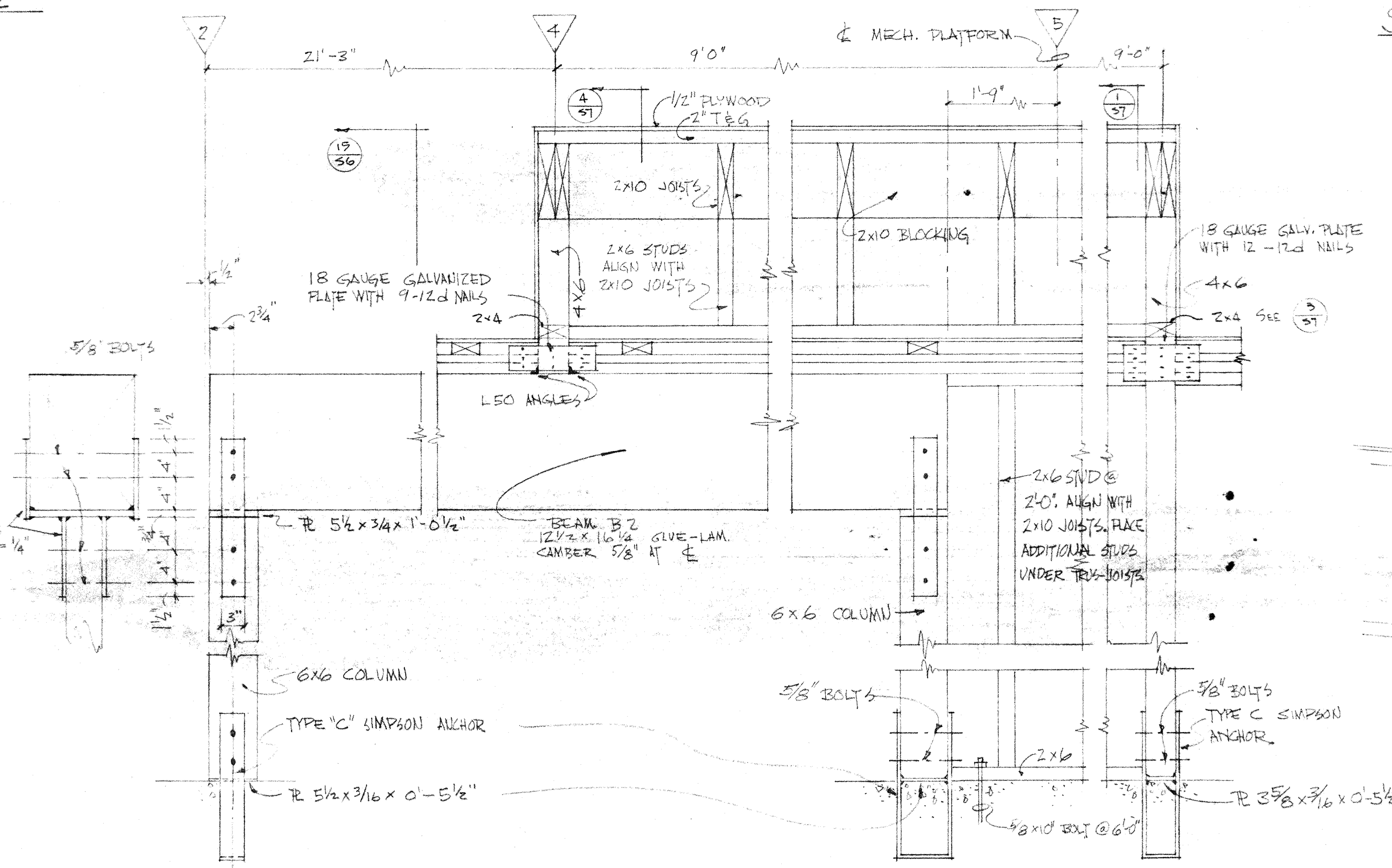
SECTION 3/S7 MECHANICAL SPACE FRAMING K to L AND R to S



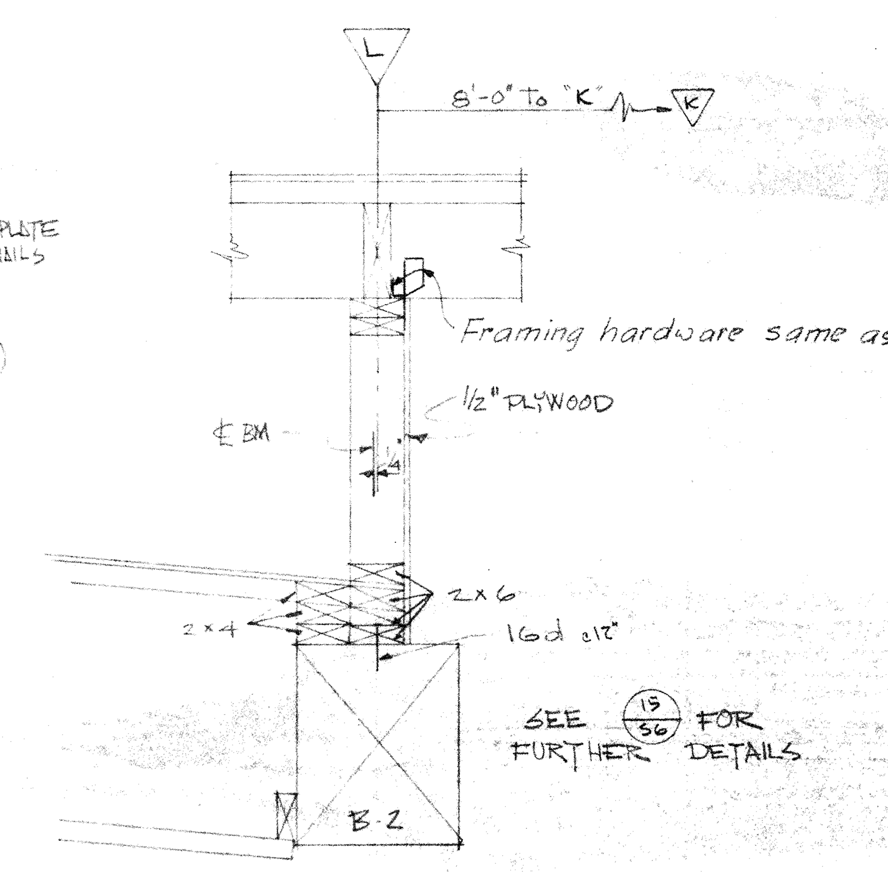
SECTION 2/S7



PLAN
MECHANICAL PLATFORM
1/4" = 1'-0"



ELEVATION
BEAM B2 & MECHANICAL PLATFORM
1" = 1'-0"



SECTION 4/S7
BEAM B2
1" = 1'-0"

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FRAMING DETAILS MECHANICAL PLATFORM

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OF 8

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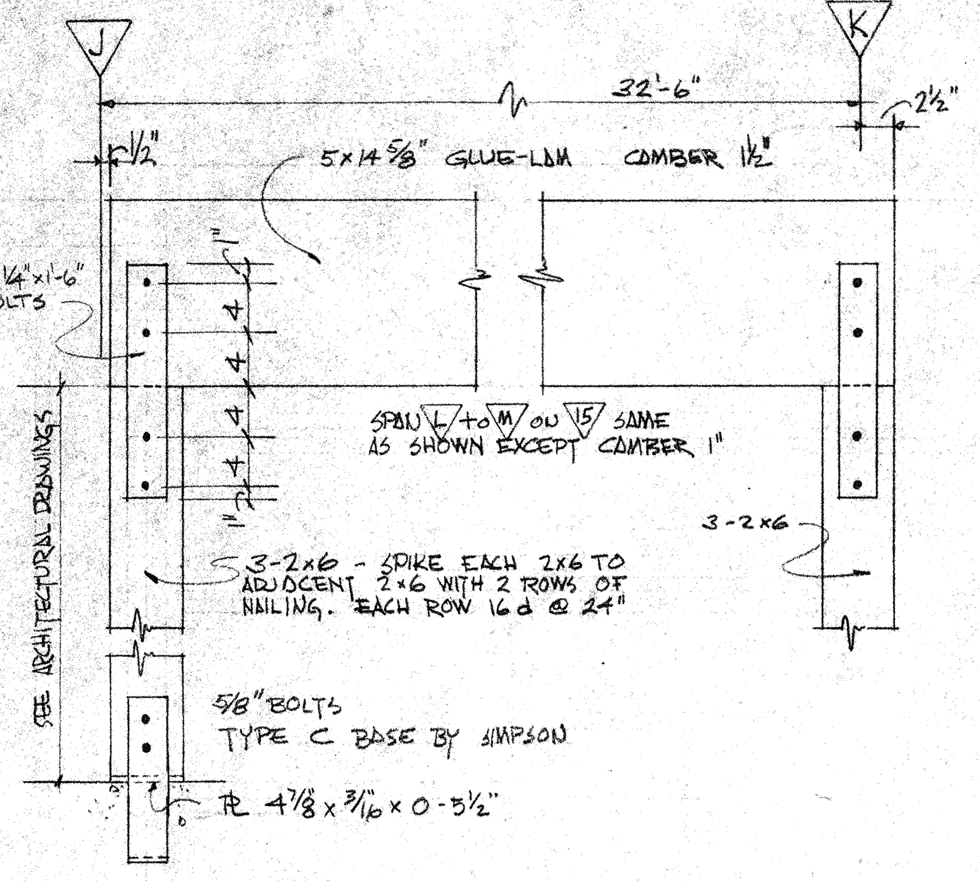
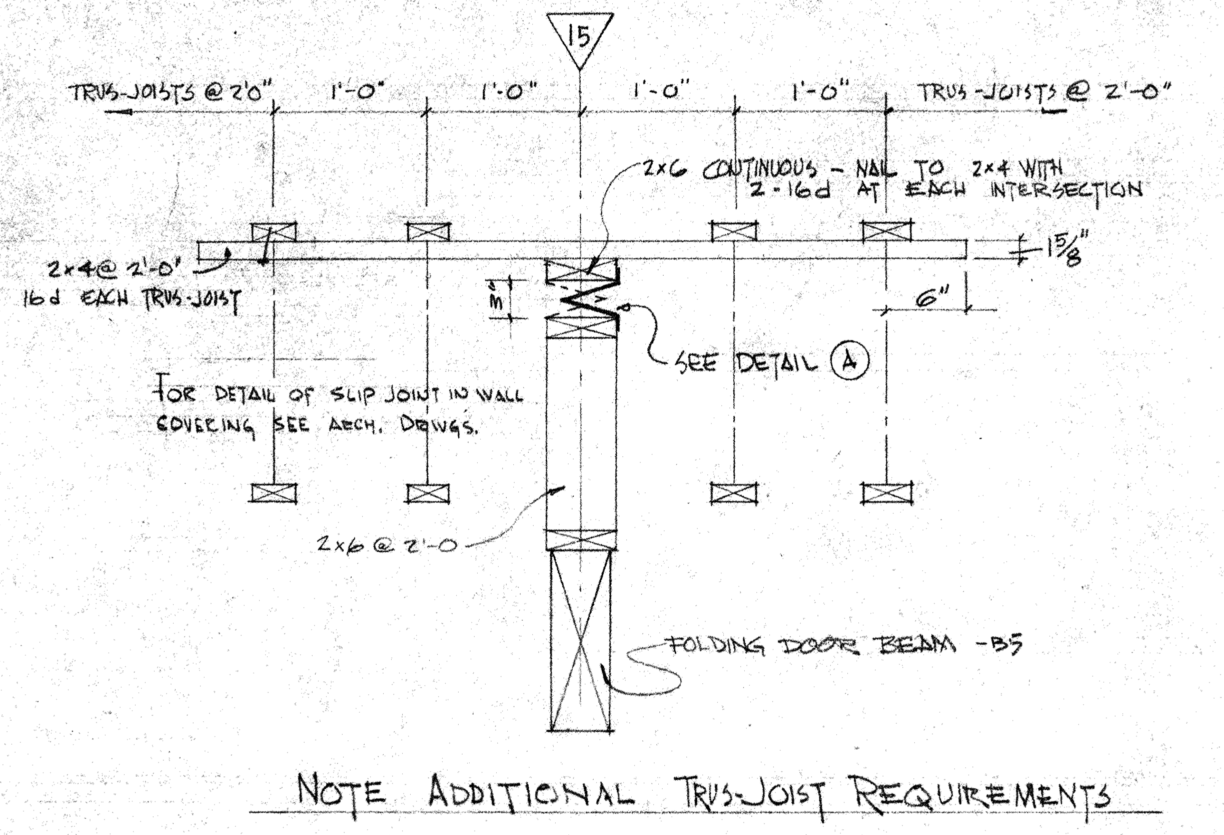
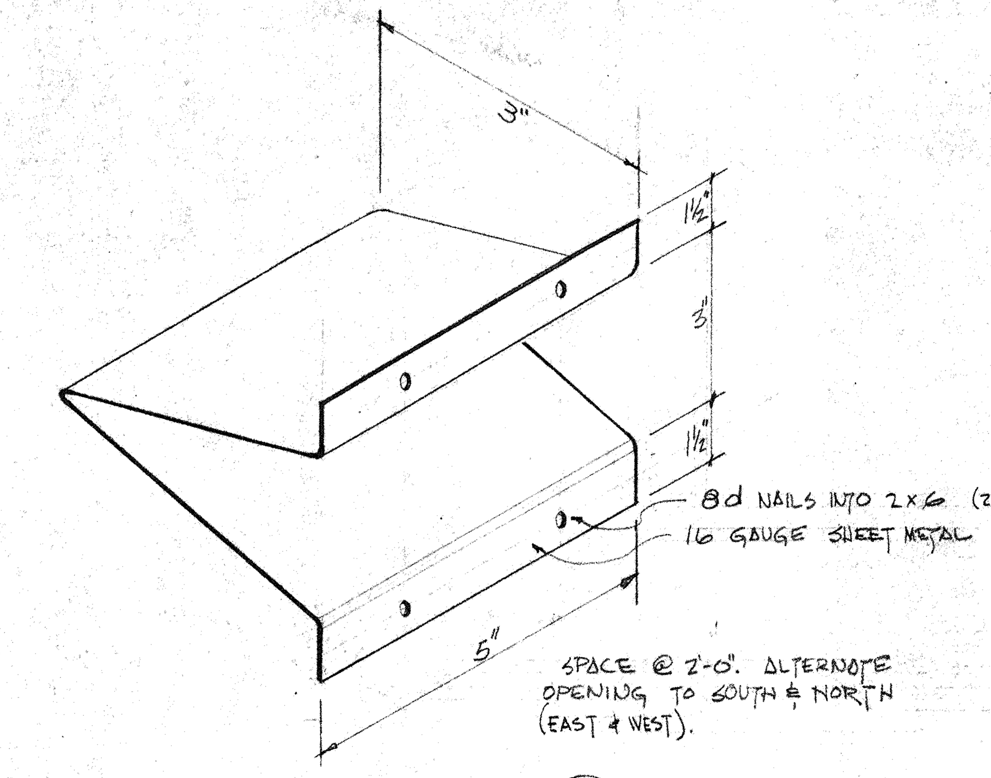


ELEVATION BEAM B5
CLASSROOM FOLDING WALL BEAM

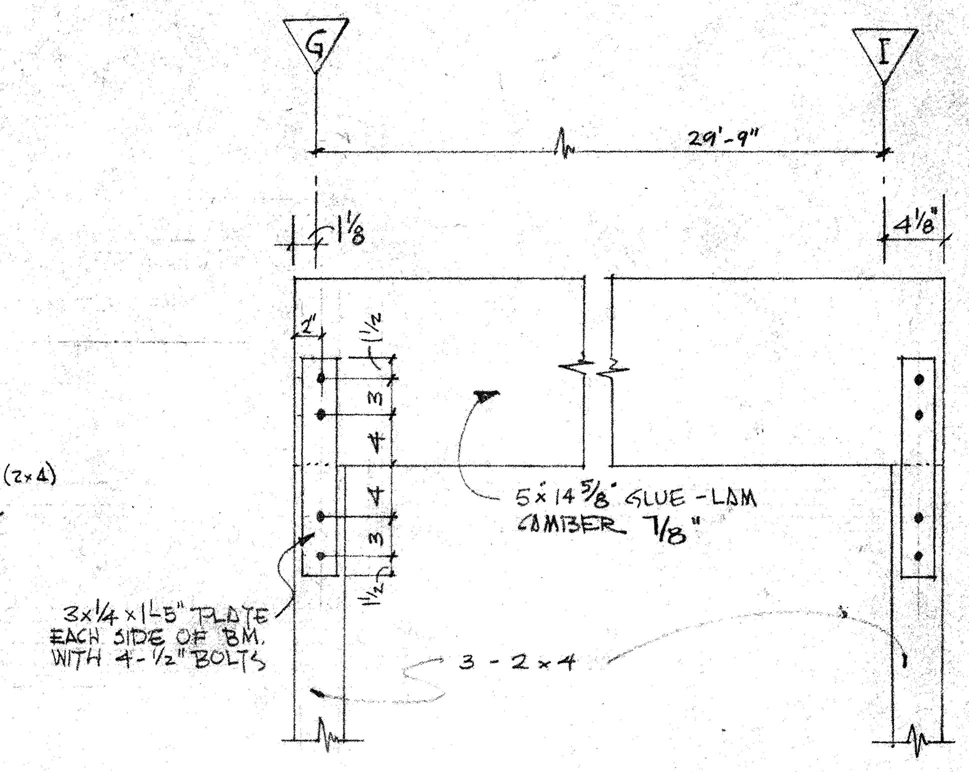


NOTE ADDITIONAL TRUS-JOIST REQUIREMENTS

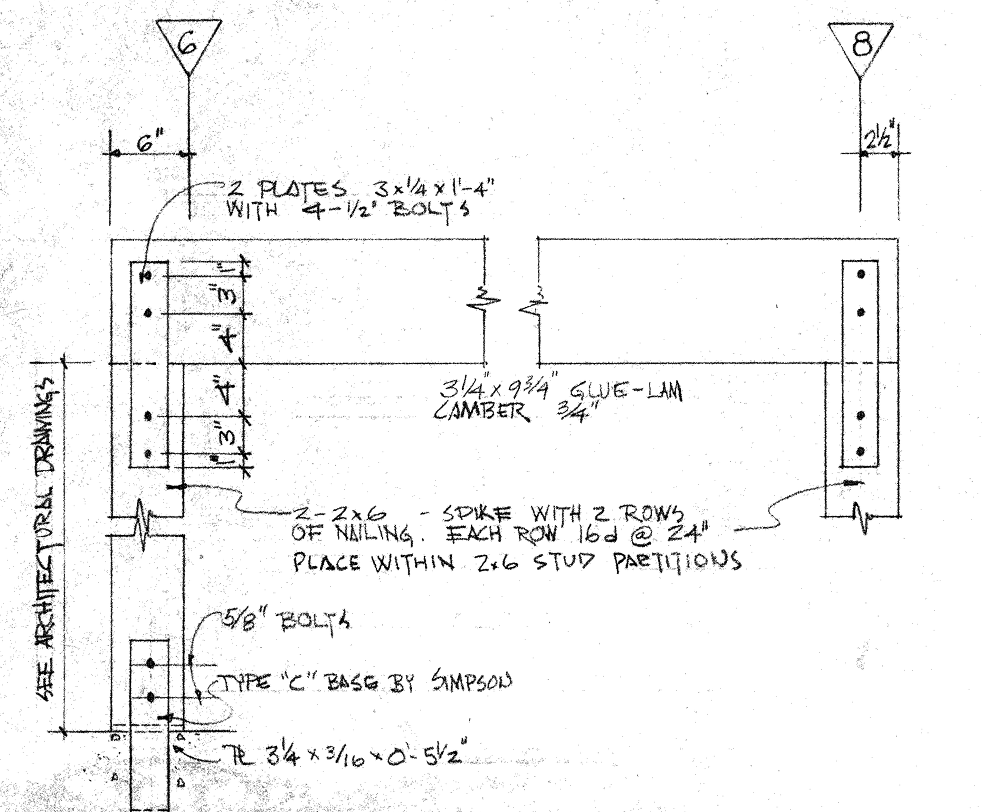
SECTION 19/S5
CLASSROOM FOLDING WALL BEAMS (B5)



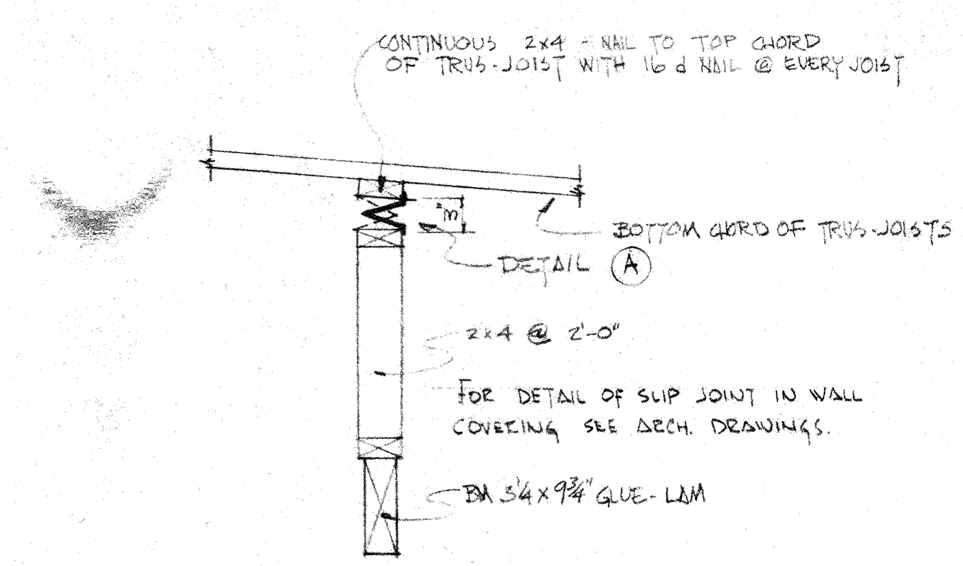
DETAIL A



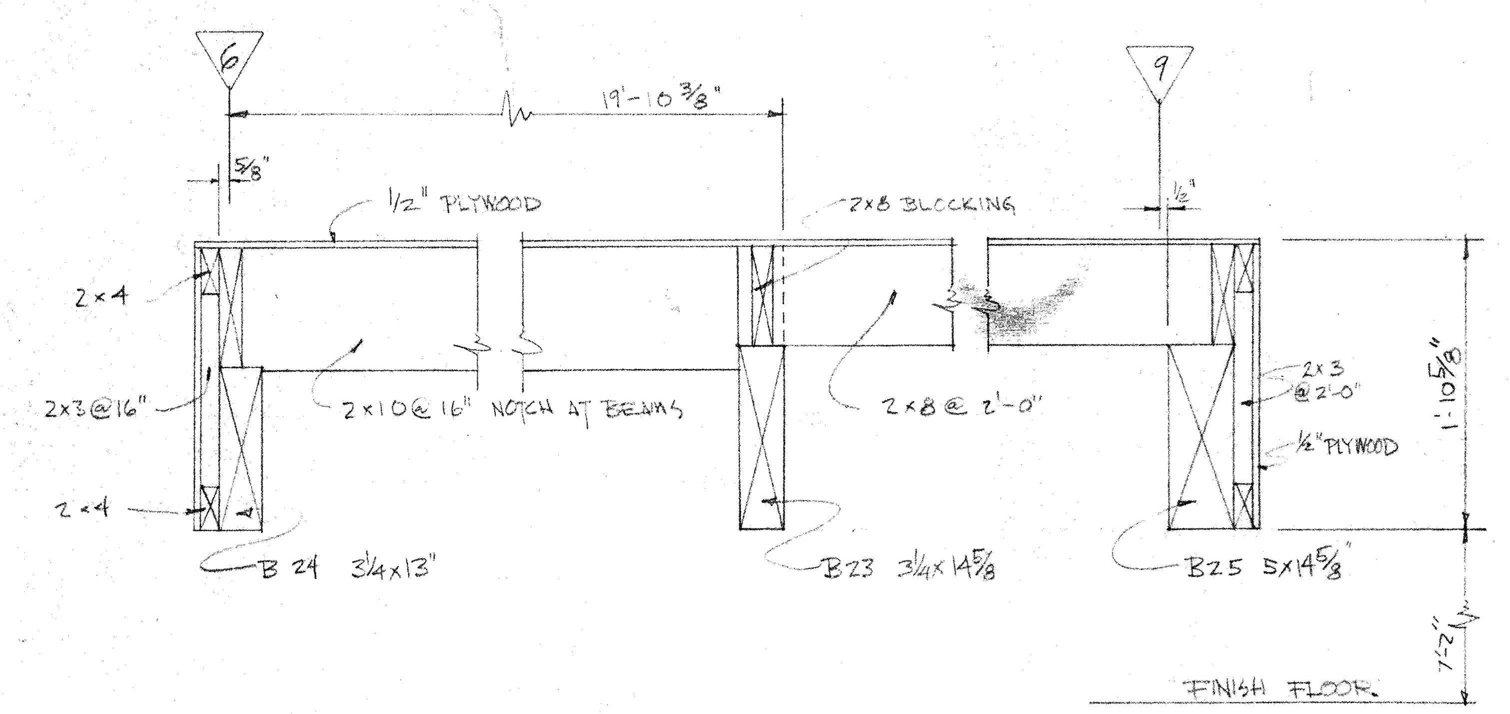
ELEVATION BEAM B25



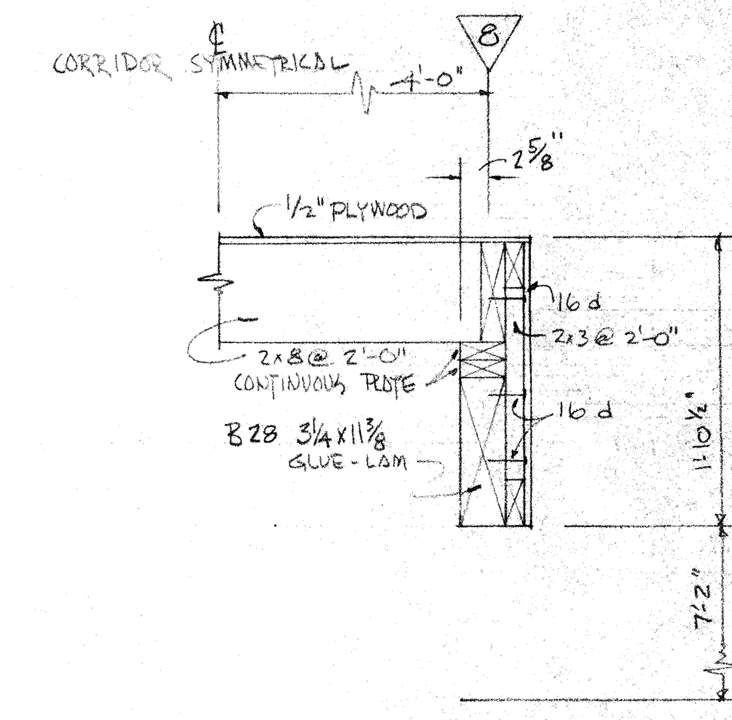
ELEVATION BEAM B6
FOLDING WALL BEAM BETWEEN CONSOL RMS.



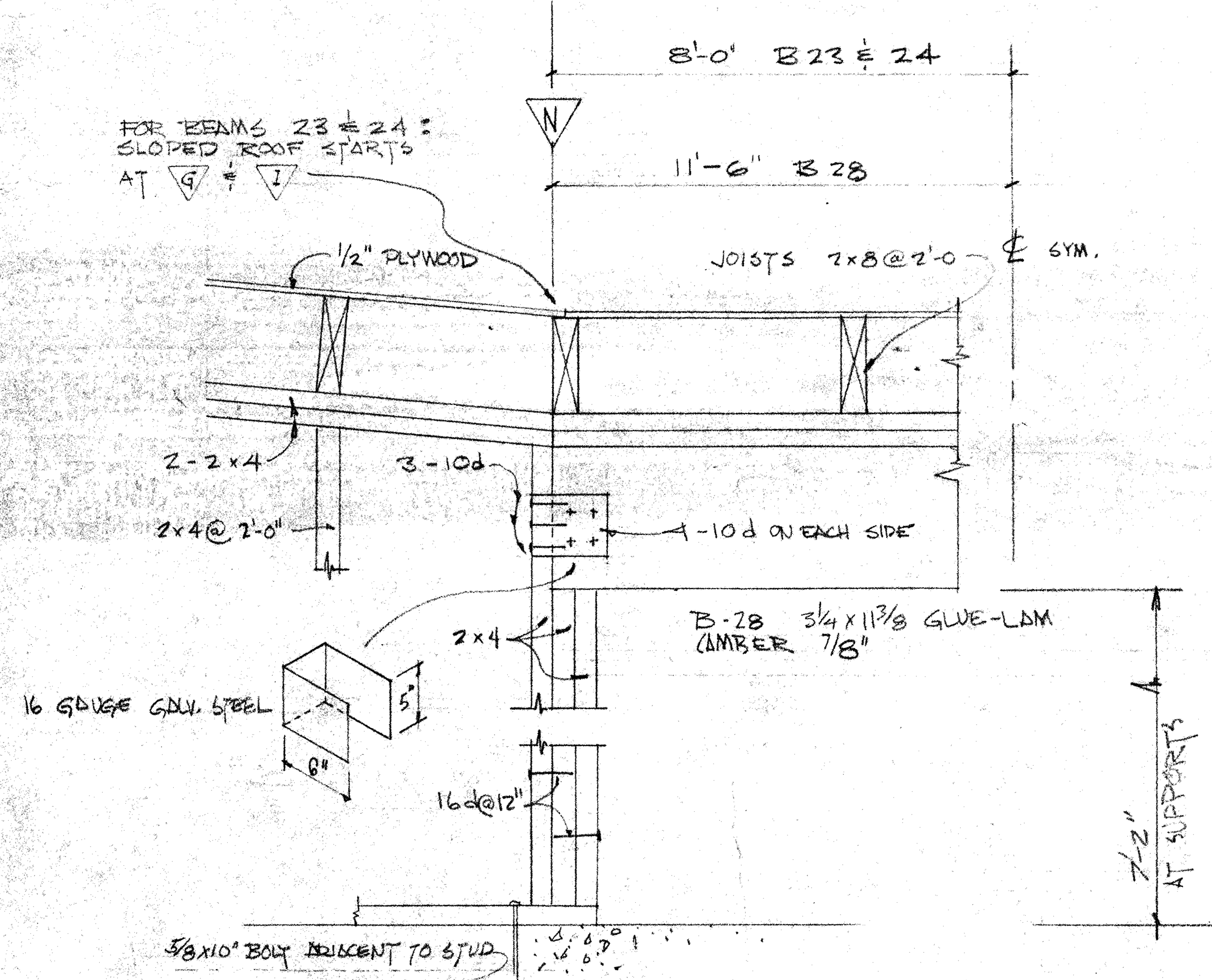
SECTION 20/S5
FOLDING WALL BEAM BETWEEN CONSUL RMS



SECTION 21/S5 ENTRY HALL FRAMING

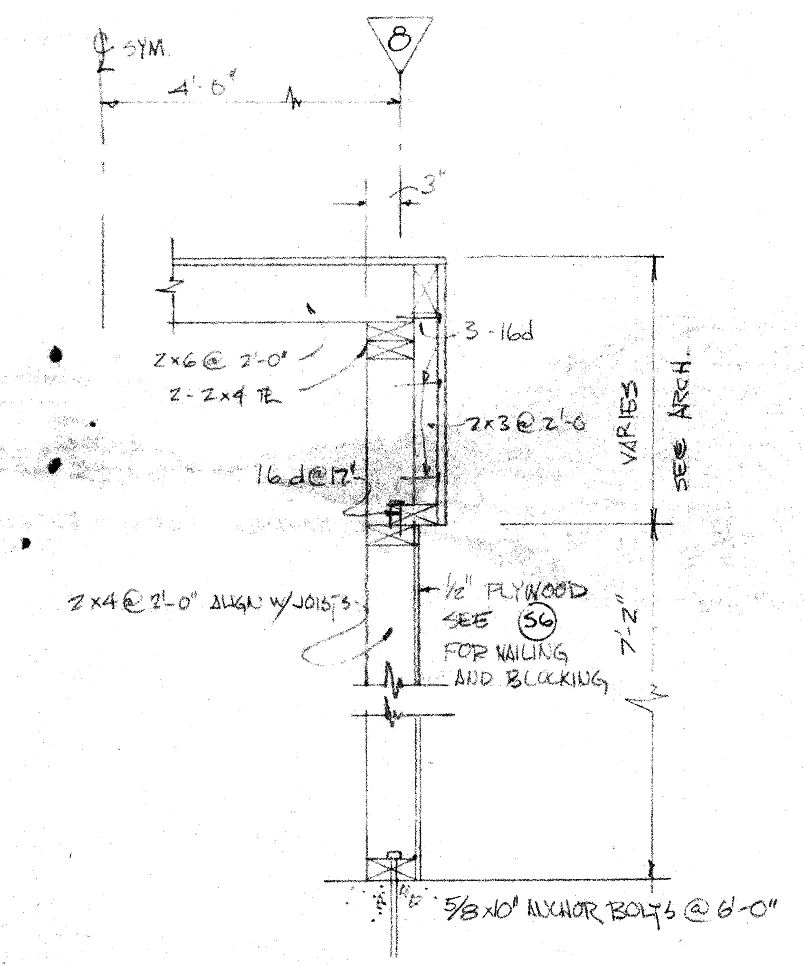


SECTION 22/S5 BM. B28



ELEVATION - BEAMS 23, 24, & 28

NOTE: ELEVATION B28 SHOWN. ELEVATION B23 AND B24 SIMILAR EXCEPT AS NOTED. CAMBER B23: 1/4" CAMBER B24: 1/4"

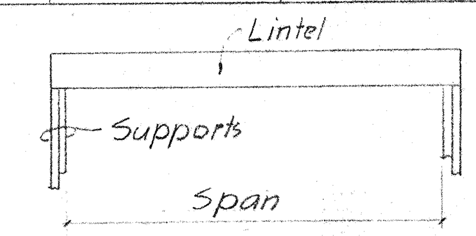


CORRIDOR WALL - SECTION 23/S5

LINTELS IN STRUCTURAL WALLS

For other lintels see architectural drawings and U.B.C.

	Lintel in wall		Max. Span	Lintel	Lintel Support
1	On D		10'	7x11 3/8 glue-lam	2-2x10
2	On E		10'	5x11 3/8 glue-lam	2-2x10
3	do	at 33 + 31'	6'	5-2x10 Each row of nails 16d @ 2-0 staggered	1-2x10
4	do	at 33 + 6'	3'	4-2x10 Each row of nails 16d @ 2-0	1-2x10
5	On 9 & 7; North & South walls of kitchen & janitor	Between E & G	3'	2-2x4 16d @ 12"	1-2x4
6	On 2 & 21		6'	3-2x6 Each row of nails 16d @ 2-0 staggered	1-2x6
7	On S & R; On J	Between 8 & 9; Each side of 5	3'	3-2x4 Each row of nails 16d @ 12"	1-2x6
8	On K & L	Between 5 & 6	3'	3-2x8 Each row of nails 16d @ 2-0 staggered	1-2x6



Where 2-2x10 are provided for supports nail 2x10's with 2 rows of nailing. Each row: 16d @ 24"

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Federal Way School District No. 210
King County, Washington

MISC. DETAILS - CLASSROOM UNITS & CORRIDORS

S 8
OF 8

Engineer's File: B-339

GENERAL NOTES

A. GENERAL
1. The structural drawings shall govern where structural quality and adequacy are concerned.
2. Verify all dimensions for interrelationship and fit before proceeding with work.
3. Specific attention is called to location of grid lines. Use Caution!

B. CODES AND REFERENCES, BASIS FOR DESIGN
1. Uniform Building Code (UBC), 1967. This supplemented by American Concrete Institute "Building Code" (ACI 318-63); and National Lumber Manufacturers Association "National Design Specification" (NLMA), 1962.
2. Design Live Loads and Lateral Loading:
   Roof load: 25 psf
   Floor load: 40 psf
   Basic Wind 20 psf
   Seismic-UBC Zone 3
   Soil (Lateral) 30 pcf

C. SHOP DRAWINGS
1. Shop drawings and/or detailed construction drawings shall be prepared by the Contractor. The shop drawings shall give complete information necessary for the fabrication of the components and proper placement at the site.
2. Submit shop drawings to Architect for approval three weeks prior to actual need in shop or job site. Review and/or approval by Architect does not relieve Contractor of responsibility for satisfying all requirements, including dimensional fit and the inclusion of all embedded items.

D. PREPARATION OF SITE
1. These notes apply to the building site proper which is hereby defined as limited at finished grade by a boundary located 5 feet outside buildings with their appurtenances.
2. Remove from building area all vegetation, roots, topsoil and fine silty sand, exposing gravelly sand or suitable bearing soil as approved by Architect.
3. In areas below required finished grade build up with sound compacted fill.
4. Fill shall be: Clean pit run sand and gravel containing no more than five percent material passing a No. 200 mesh sieve. Use approved material only for fill. Material at site is not suitable for fill purposes.
5. Deposit material in 6" layers compacting each layer as necessary to obtain not less than 95% of modified AASHO maximum density.
6. Build up entire area uniformly.
7. Provide means necessary to prevent puddling on entire building site.
8. See specifications for testing and inspecting of embankment.

E. FOUNDATIONS
1. Assumed soil bearing value = 4000 psf (Max. allowed).
2. Excavation for footings shall not be started until site is completely prepared as outlined in D above.
3. All footings shall be founded on sound undisturbed soil or on fill prepared as given in D above.
4. Keep excavated surfaces free from frost and accumulation of water. Remove all disturbed or softened soil. Excavation shall extend in depth as necessary to obtain the allowable bearing value.
5. Backfill under slab and around foundation walls including trenches for mechanical and electrical installations shall be thoroughly compacted by mechanical tamper in 6" layers. Brace wall if necessary to avoid overstressing or displacing it.
6. Architect will review foundation during site preparation, during excavation for footings, when it is exposed, and during backfilling.

F. CONCRETE MATERIALS
1. Portland cement, aggregates and water: Refer to U.B.C.
2. Additives: Sika Plastiment #2, minimum of 2 fl. oz. per sack of cement.
3. Strength: Minimum compressive strength of 3000 psi at 28 days.
4. Maximum slump: 3" for slab and footings; 4" for walls and pedestals.
5. Submit mix designs for approval by Architect two weeks prior to concreting.

G. CONCRETE PLACEMENT AND DETAILS
1. For mixing and placing concrete refer to U.B.C.
2. Protection for reinforcement shall be per U.B.C. and A.C.I. 318-63.
3. Corners and intersections: Use corner bars to match all horizontal bars; lap each side 1'-6" min.
4. Bar splices: 24 diam. min.; none less than 12". In cantilever wall, splice as shown.
5. Hold bars firmly in correct position. Use of nails to space reinforcement from forms is not allowed.

H. REINFORCING AND STRUCTURAL STEEL MATERIALS
1. Reinforcing steel: Intermediate grade ASTM A-615-68, Grade 40.
2. Structural shapes and plates: ASTM A36.
3. Bolts and nuts: ASTM A-307.
4. Welding by welders certified per AWS recommendations.

I. LUMBER AND PLYWOOD
1. All lumber: Douglas Fir, Coast Region, except Decking (Hemlock, West Coast)
   Stress grade:
   Light framing (studs, plates, blocking) .... 1500f Industrial L.F.
   Joists .... Construction J. & P.
   Columns .... Construction P. & T.
   Decking .... Commercial Dex
   All lumber S4S
2. Plywood:
   a. Roof and exterior walls: Douglas Fir, Grade C-C exterior.
   b. Interior walls and floor diaphragm: Douglas Fir, Structural interior C-D.
   All plywood to have DFPA (APA) stamp of quality control.
3. Moisture content and finish: See specifications.

J. GLUED-LAMINATED TIMBER COLUMNS
Columns are to be Douglas Fir (Coast Region) combination B, adhesive for wet conditions of use, AITC Industrial Grade manufactured per CS253-63, and bear AITC quality control stamp. The columns shall have the ends dipped for 3 minutes minimum in 5% pentachlorophenol solution prior to applying end sealer.

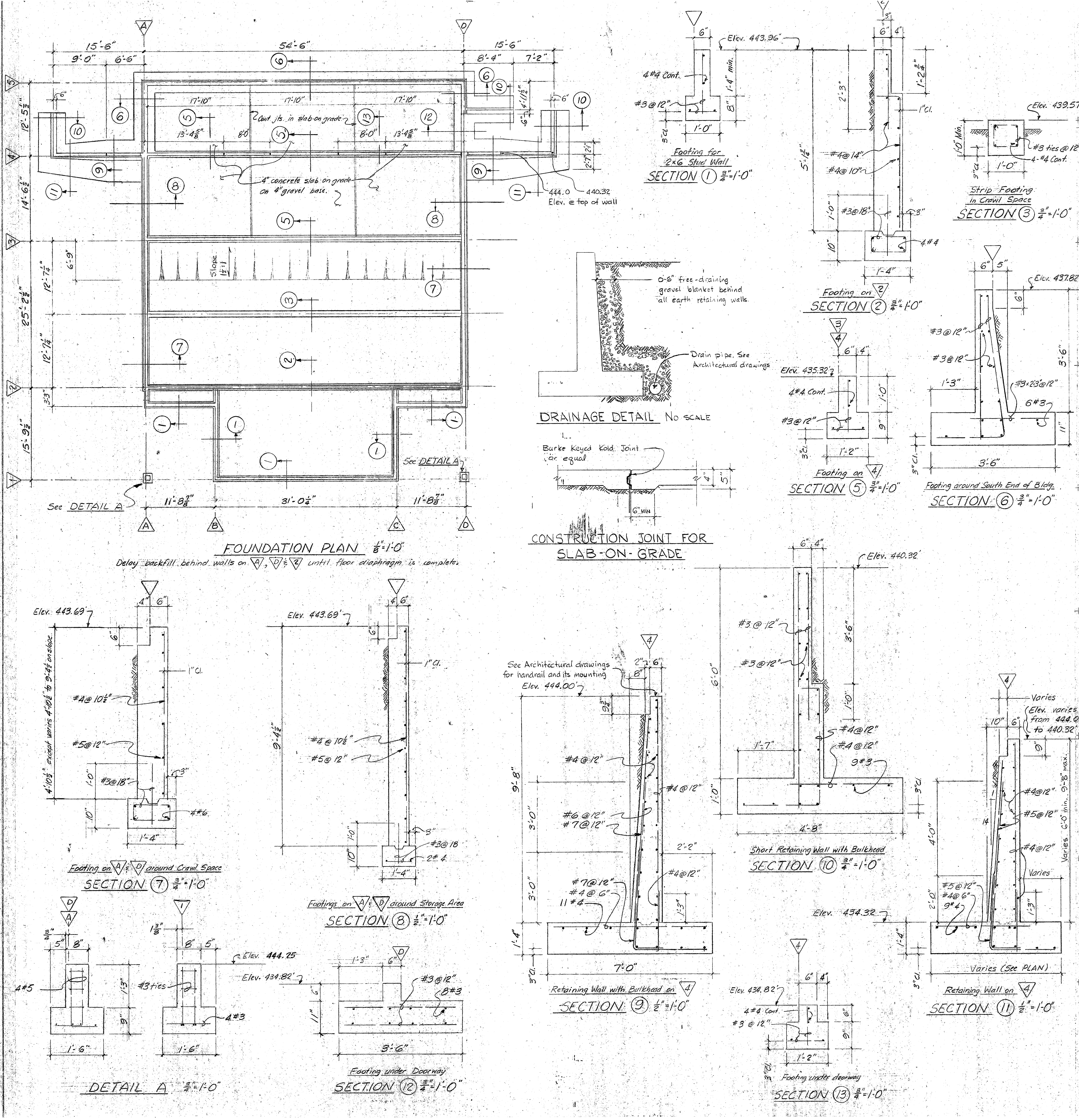
K. TRUS-JOISTS
1. Materials, Design and Fabrication: As described in International Conference of Building Officials Report No. 1694.5, 8 September 1967.
2. Design Loads:
   (a) Classroom units: 25 psf live load and 15 psf dead load.
   (b) Dead loads given include weight of Trus-Joists.
3. Depths of Trus-Joists given are out-to-out, true and full.

L. CONNECTION HARDWARE
Connection hardware (called "Simpson") specified on drawings is manufactured by Simpson Company of San Leandro, Calif. Use nails furnished with hardware. Use washers where bolt heads or nuts bear on wood.

M. FRAMING DETAILS
1. Framing details shall be per U.B.C. requirements.
2. Joints and Splices:
   (a) Splices shall not be allowed in studs and joists.
   (b) Joints in upper and lower member of top plate shall be staggered not less than 4 feet and shall occur at center of studs.
   (c) Foundation plate shall be spliced between studs. Use scab same size as plate. Minimum of 4-16d nails into each end of splices.
3. Blocking and Bridging:
   (a) In stud walls space 2 x 6 blocking at 4'-0". Place blocking to coincide with plywood joints.
   (b) All roof joists shall be blocked at supports. Roof joists over 8' in span shall be cross bridged at midspan.
   (c) Trus-Joists shall be bridged with continuous 2 x 6 at intervals shown on drawings.
4. Nailing
   (a) Studs to top plate ....4-16d toe nails
   (b) Studs to foundation plate.4-16d toe nails
   (c) In Exterior bearing walls:

   Top member of plate to bottom member .... 16d @ 12"
   Stagger specified nailing into 2 rows.
   (d) In Interior bearing walls:
   Top plates and associated bolcking are bolted. Nail sufficiently to maintain rigidity and alignment prior to bolting.
   (e) Trus-Joists nailing to plate: Use nails provided with Trus-Joist by manufacturer.
   (f) Nails shall not be driven within 6" of the ends of Trus-Joists chords, nor within 3" on either side of a panel joint. Nails which normally would be driven into Trus-Joists within these regions shall be offset to fall outside these regions.
   (g) Other minimum nailing: See Chapter 25 in U.B.C.
   (h) Nailing and framing hardware specified are minimum. Provide adequate nailing to obtain well-connected structures.

O. MISCELLANEOUS
For locacation of foundation or sill bolts, refer to framing details.



NOTE: THIS SHEET HAS NOT BEEN CHANGED TO COMPLY WITH THE ARCHITECTURAL DRAWINGS REVISED & DATED 2-27-73

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GENERAL NOTES & FOUNDATION

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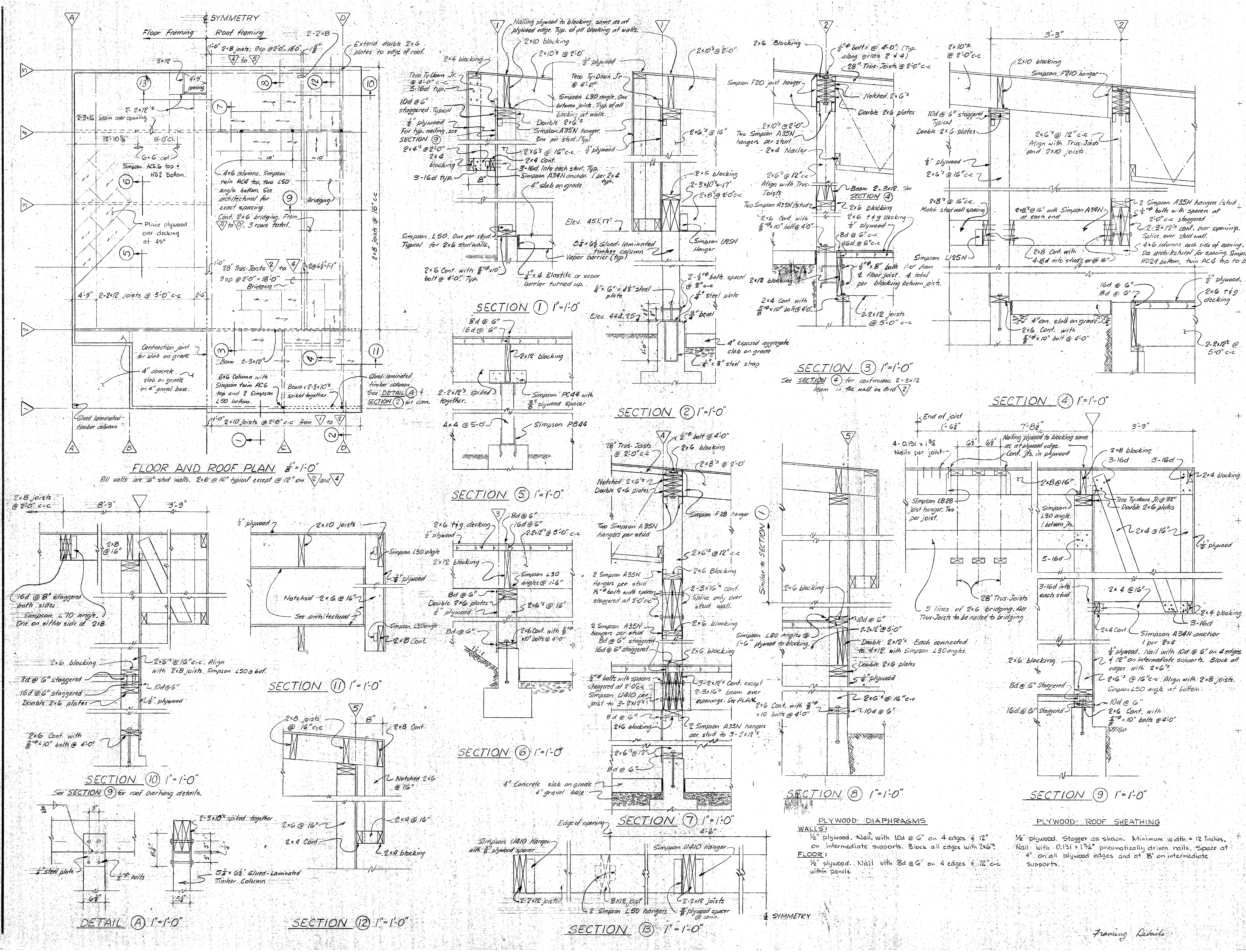

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FRAMING DETAILS

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S2

Framing Details

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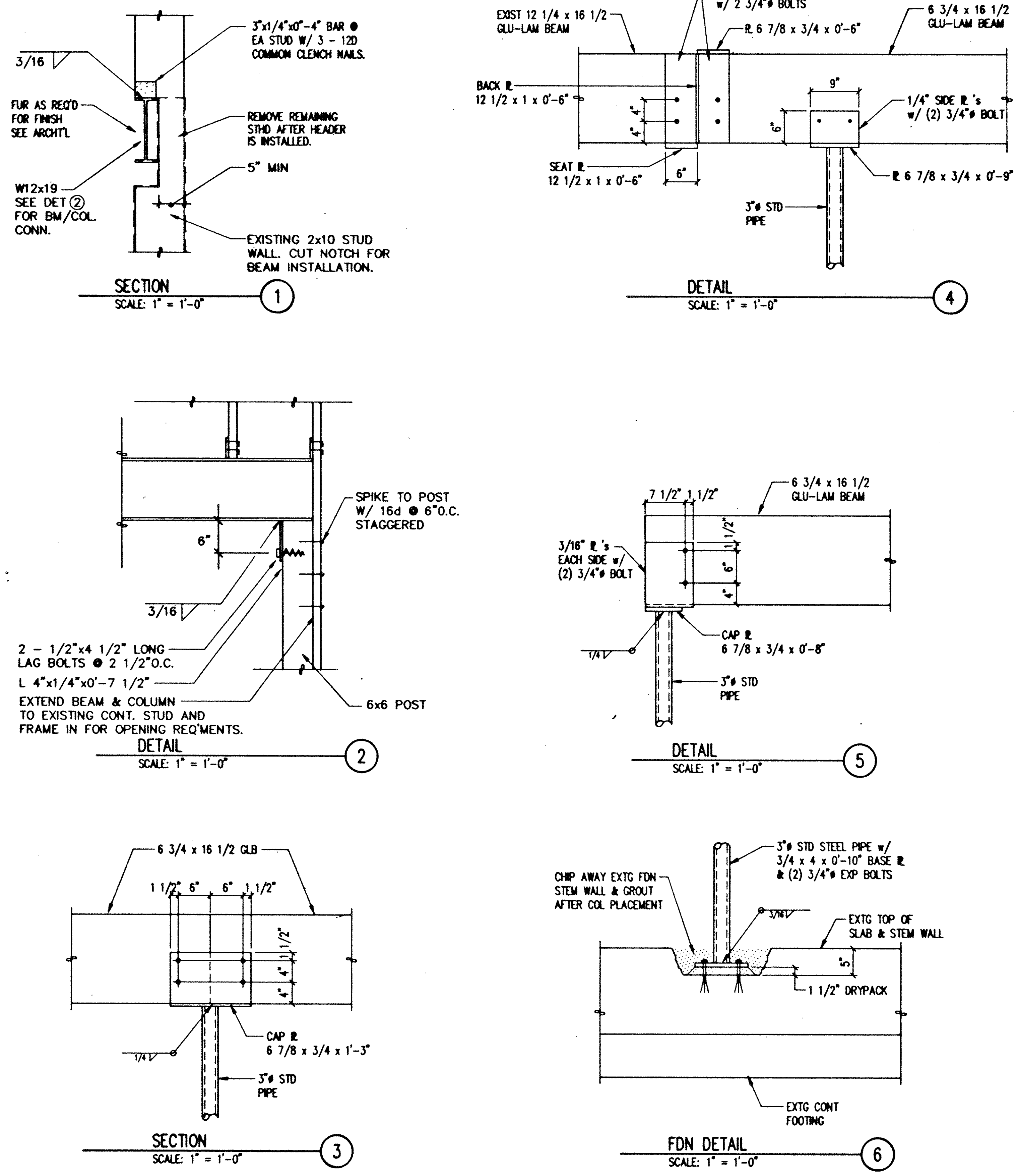

STRUCTURAL NOTES

The following notes apply except where shown otherwise.

CODE
Uniform Building Code, 1985.

LIVE LOADS
Roof 25 psf (snow).

TIMBER
Structural timber and lumber to be stress grade Hem-Fir or Douglas Fir as follows:

USE	SPECIES	GRADE
4 x 12 and larger	Douglas Fir	No. 1
6 x beams	Douglas Fir	No. 1
Exterior & bearing wall studs	Hem-Fir	No. 2
Roof joists, floor joists	Hem-Fir	No. 2
Interior studs at non-bearing walls	Hem-Fir	Standard
All other lumber	Hem-Fir	Standard/Better

Bolt heads and nuts bearing against wood to be provided with M.I. washers except bearing on or installed within 1" of masonry or concrete to be treated with a approved preservative. Solid blocking of not less than 2" nominal thickness shall be provided at ends and at all supports of joists and rafters. Between supports provide blocking or bridging at 8'0" o.c. for floor joists, 10'0" for roof joists. Typical sill bolts to be 3/4" diameter at 4'0" o.c.; embed 5". Light gage metal framing connectors and their required fasteners shall be "Strong Tie" by Simpson Company, or approved equal, all other nailing shall be per UBC Table No. 25-Q.

STRUCTURAL GLUED-LAMINATED LUMBER
Shall be fabricated to the requirements of Product Standard PS 56. Lumber shall be visually graded western species, combination 24F-V4 for simple beams and 24F-V8 for cantilever beams, per UBC Table 25C-1. Laminated members to be AITC certified. Use waterproof glue.

PLYWOOD
Plywood roof and wall sheathing to be C-D INT-APA (with exterior glue) per UBC Standard No. 25-9, unless noted otherwise. Maximum nail spacing shall be as follows: 6" o.c. at all supported panel edges; 10" o.c. at intermediate supports at floors; 12" o.c. at intermediate supports at roofs and walls. Nails shall be as follows: 8d hot dip galvanized for 1/2" plywood; 10d hot dip galvanized for 5/8" and 3/4" plywood. Nails shall be 10d hot dip galvanized for 1/2" wall sheathing. Stagger end laps at roof and floor sheathing. All panel edges to be blocked at shear walls and as indicated on plans for roof and floor sheathing.

Support shall be supplied to all plywood edges with galvanized plyclips, blocking, tongue and groove plywood joints or other approved methods per APA recommendation. Plyclips are not allowed for floor sheathing.

PRESERVATIVE TREATMENT
All lumber that is in contact with or installed within 1" of concrete or masonry or exposed to weather shall be treated with a preservative of pentachlorophenol. Glued laminated lumber shall be treated after gluing to a net retention of 0.30 pounds per cubic foot for lumber above ground. Glued laminated lumber shall be treated in accordance with the current AWPA Standard C-28. Lumber and plywood shall be treated in accordance with AWPA C-2 and C-9 respectively. Net retention for lumber and plywood shall be 0.40 pounds per cubic foot for material in contact with ground, concrete or masonry. Net retention for lumber and plywood that is to be used above ground shall be .25 pounds per cubic foot. Where possible, precut material before treatment. Handle treated lumber and treat penetration damage in accordance with AWPA M-4. Field cuts and holes shall be treated in accordance with the current AWPA M-4.

STRUCTURAL STEEL
Structural Grade ASTM A36, Fy = 36,000 psi. Pipe columns ASTM A53, grade B, Fy 35,000 psi. Structural tubing columns ASTM A500, grade B, Fy = 46,000 psi. All steel except steel embedded in concrete shall be given on shop coat of approved paint. Welds to be 3/16" minimum continuous fillet by certified welders. All bolts to be A307. During erection, structural steel shall be secured from collapsing with temporary bracing. Where expansion anchors are specified, the contractor shall submit to the structural engineer manufacturer's literature describing the anchors and listing recognized allowable shear and tension values.

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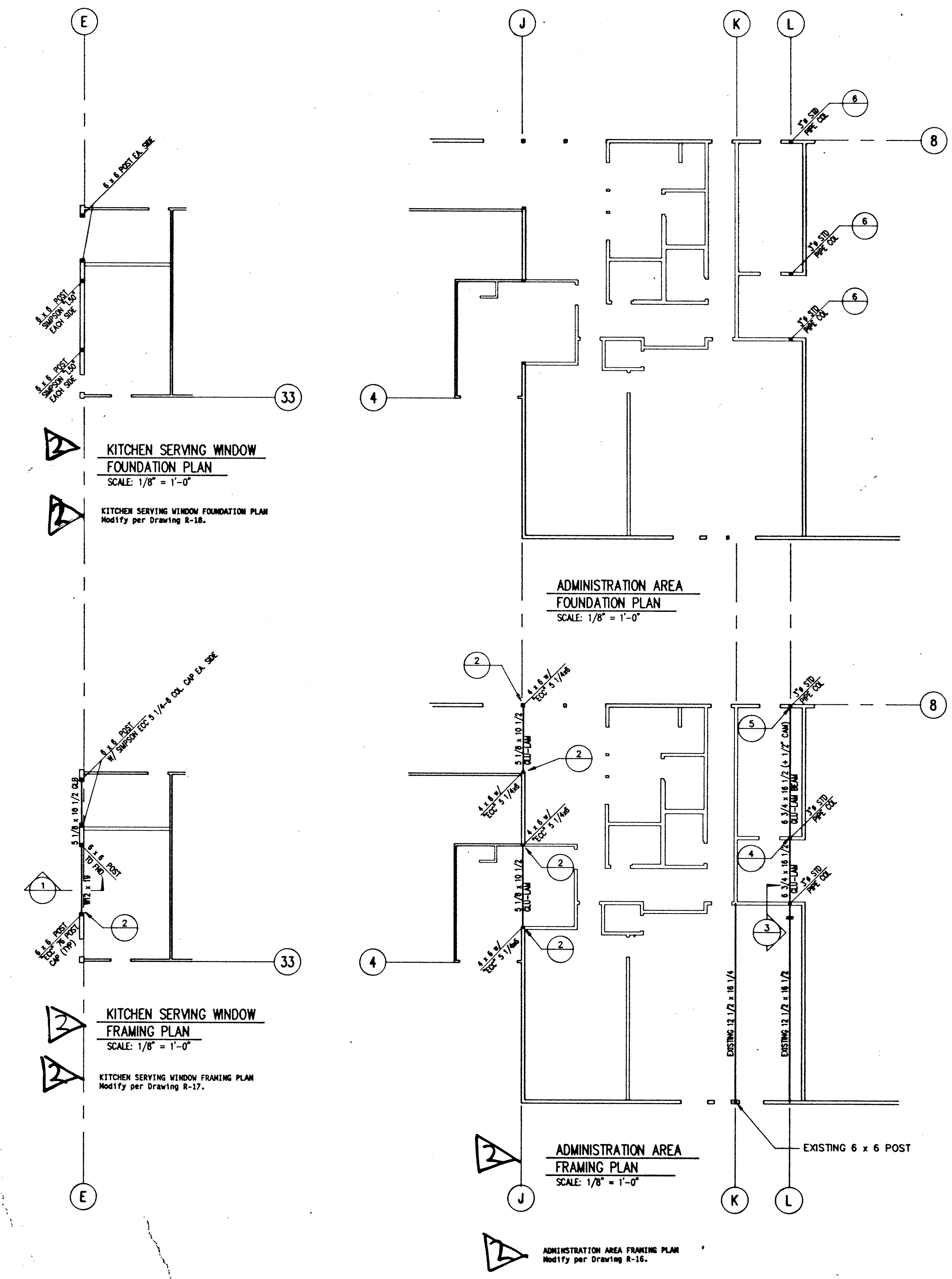

GROSS, THURMAN & deMERS, INC., P. S.
FIRSTWEST BUILDING, SUITE 402
200 FIRST AVENUE WEST
SEATTLE, WASHINGTON, 98119
206-281-8790
1-800-521-0714 Ext. 644

DRWN ---
CHKD ---
JOB# 50080
DATE 26 MAY 88

CAMELOT ELEMENTARY MODERNIZATION
FEDERAL WAY SCHOOL DISTRICT NO. 210

STRUCTURAL PLAN
SECTIONS & DETAILS

S1
1 OF 1

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Appendix F: FEMA E-74 Nonstructural Seismic Bracing Excerpts

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Life Safety Systems

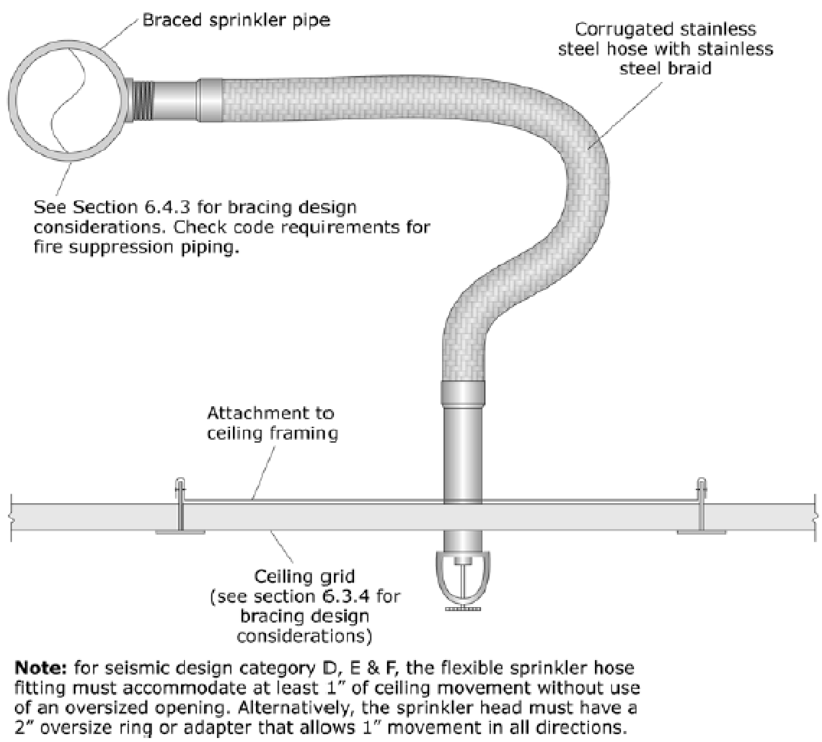


Figure G-1. Flexible Sprinkler Drop.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

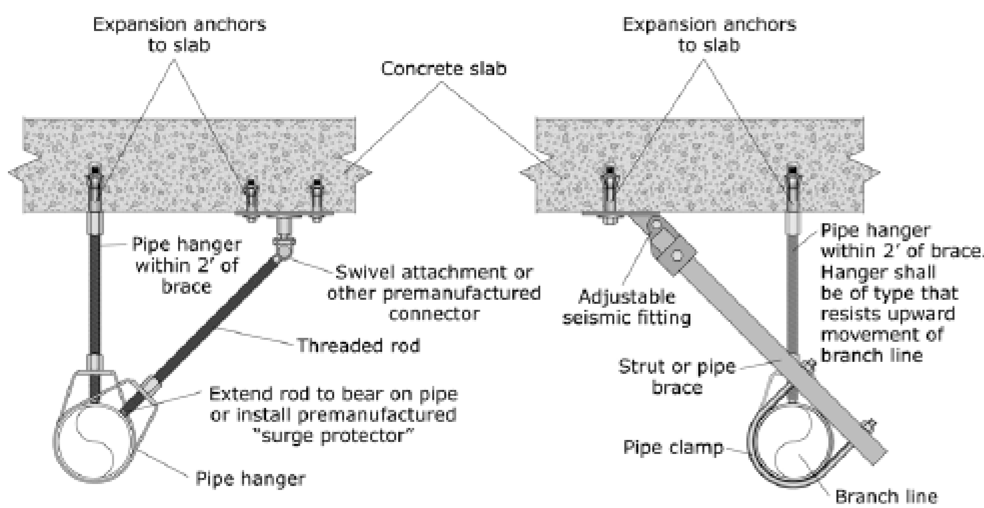


Figure G-2. End of Line Restraint.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Partitions

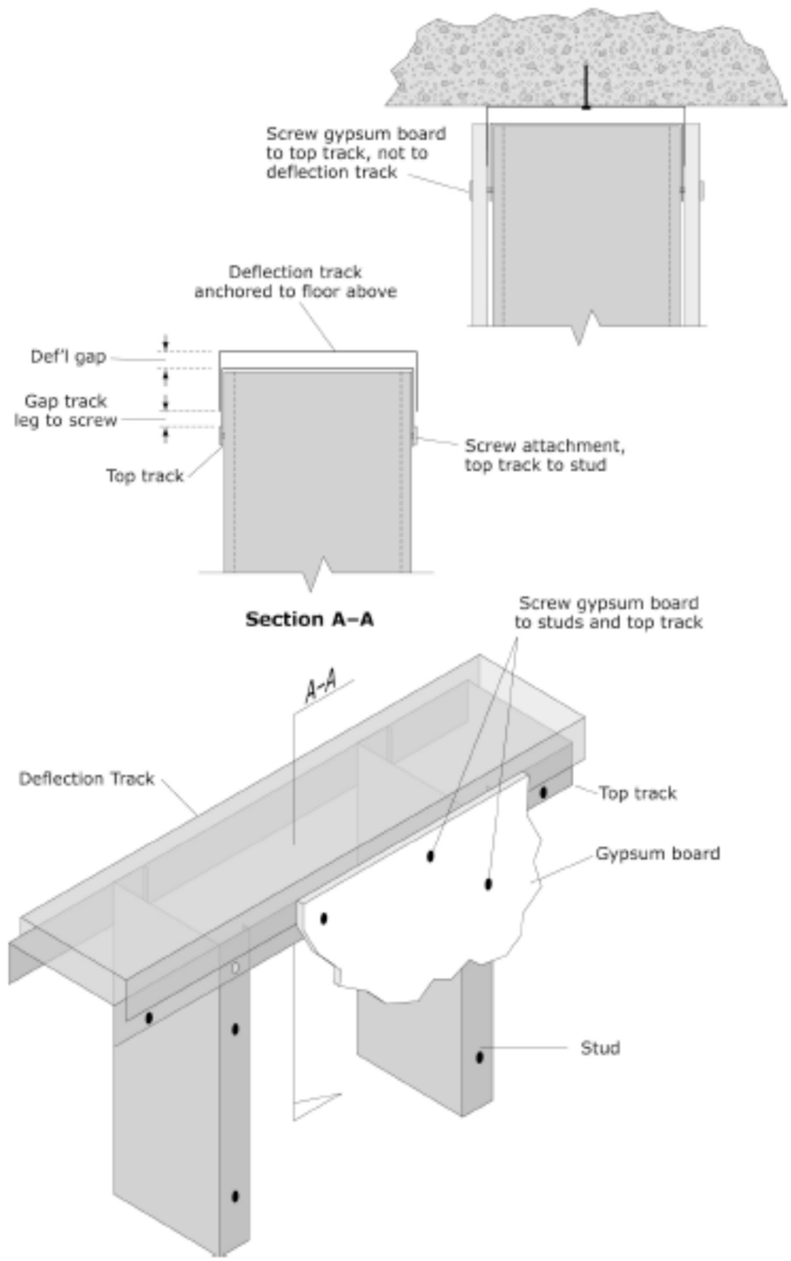


Figure G-3. Mitigation Schemes for Bracing the Tops of Metal Stud Partitions Walls.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

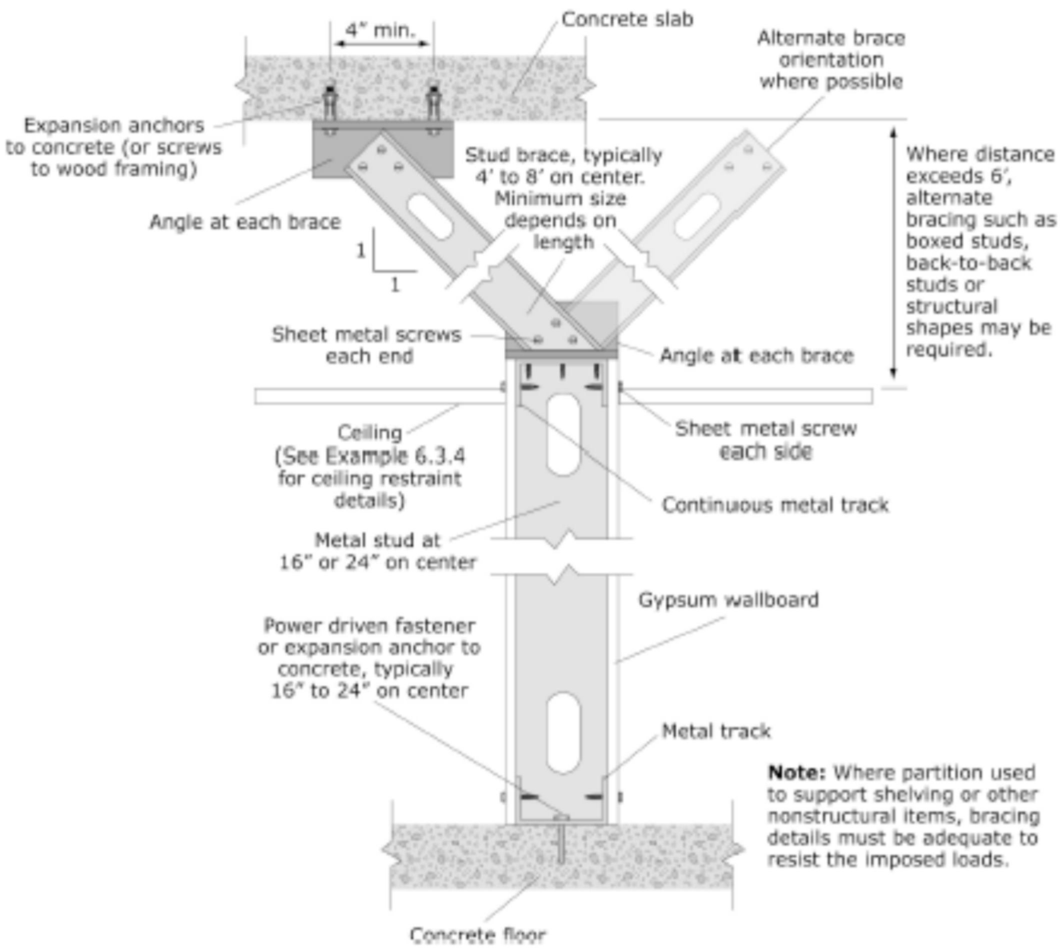


Figure G-4. Mitigation Schemes for Bracing the Tops of Metal Stud Partitions Walls.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

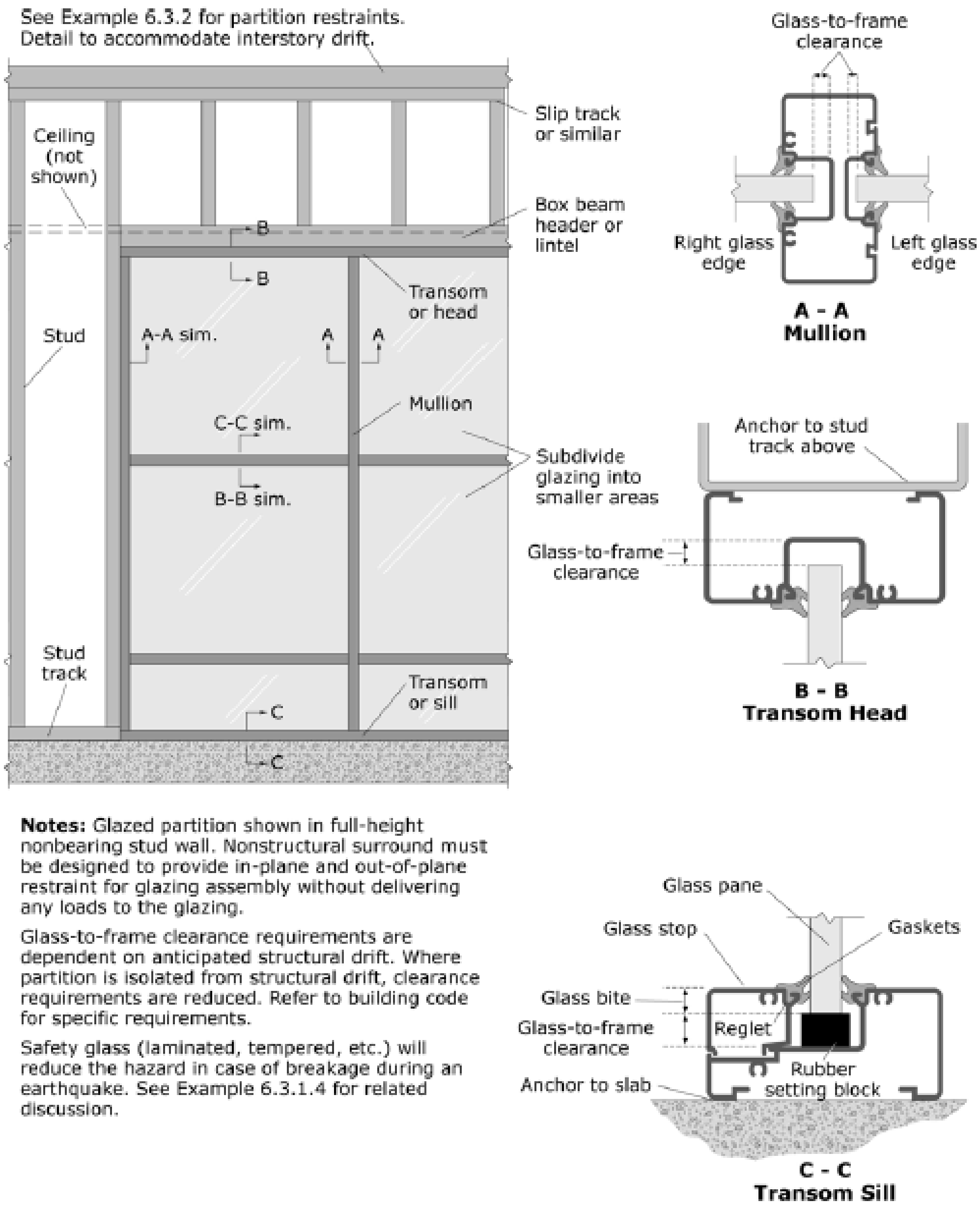


Figure G-5. Full-height Glazed Partition.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

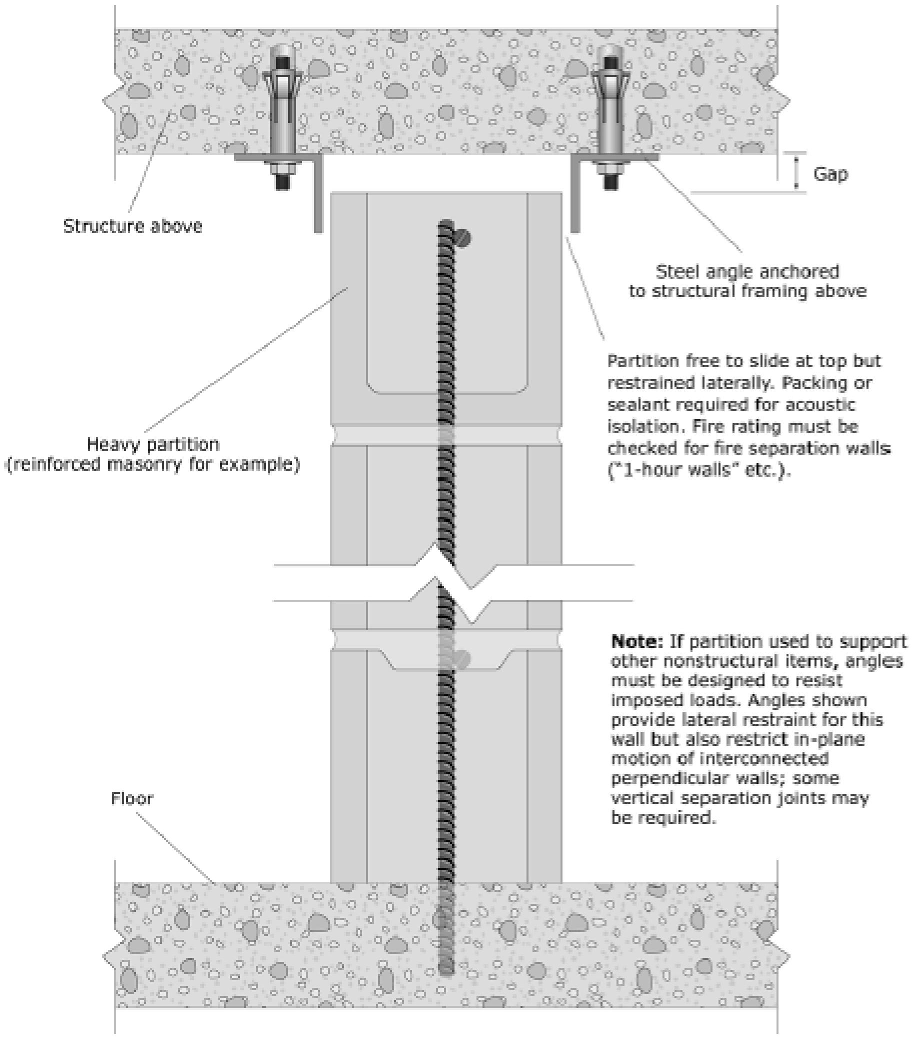


Figure G-6. Full-height Heavy Partition.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

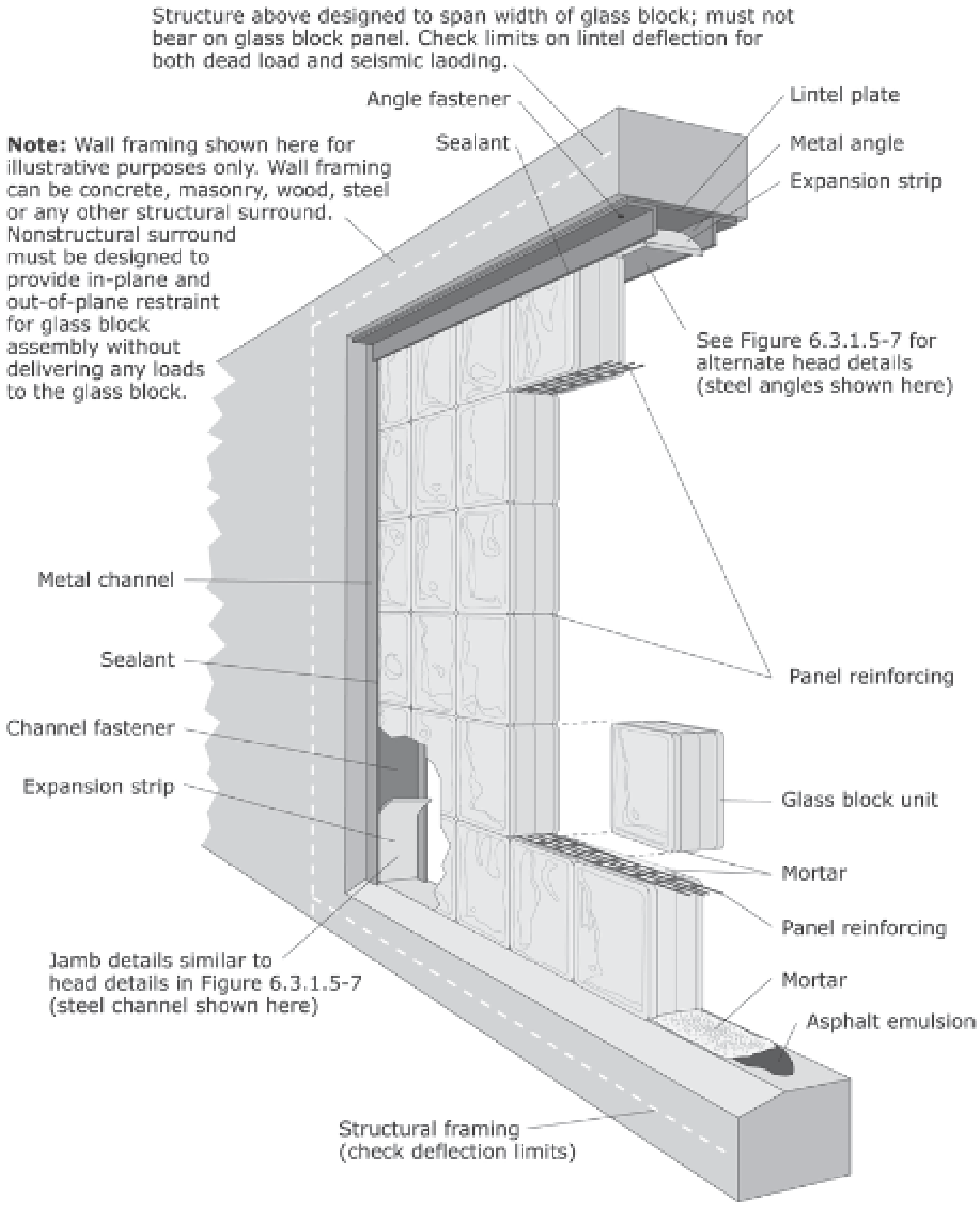


Figure G-7. Typical Glass Block Panel Details.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Ceilings

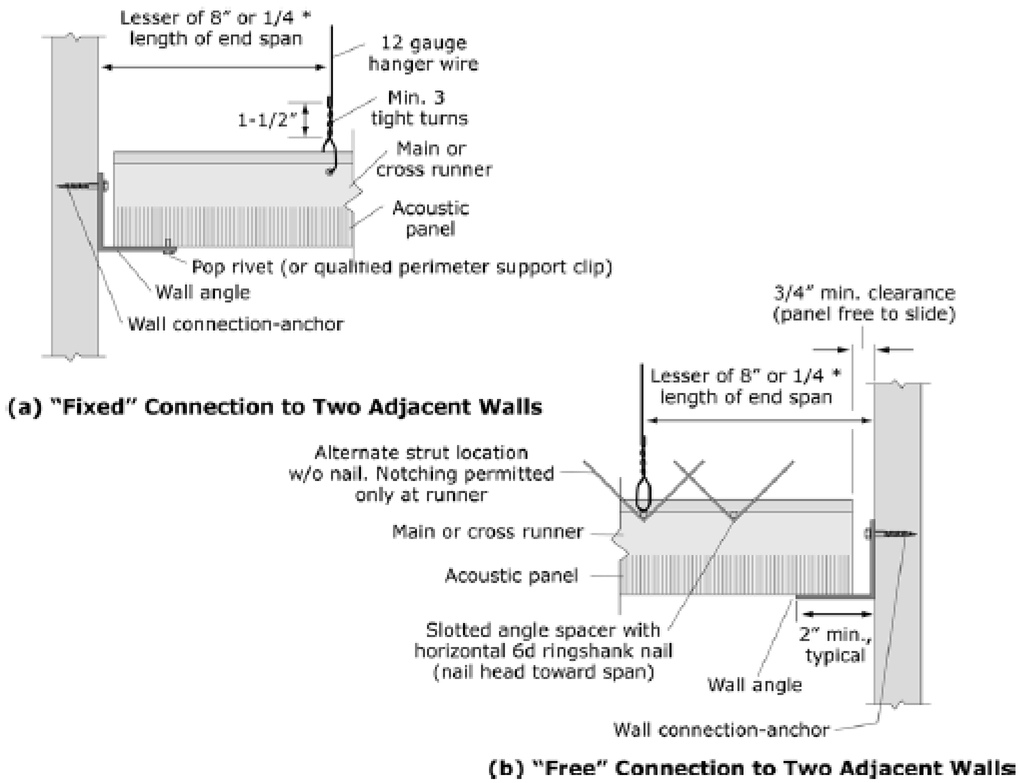
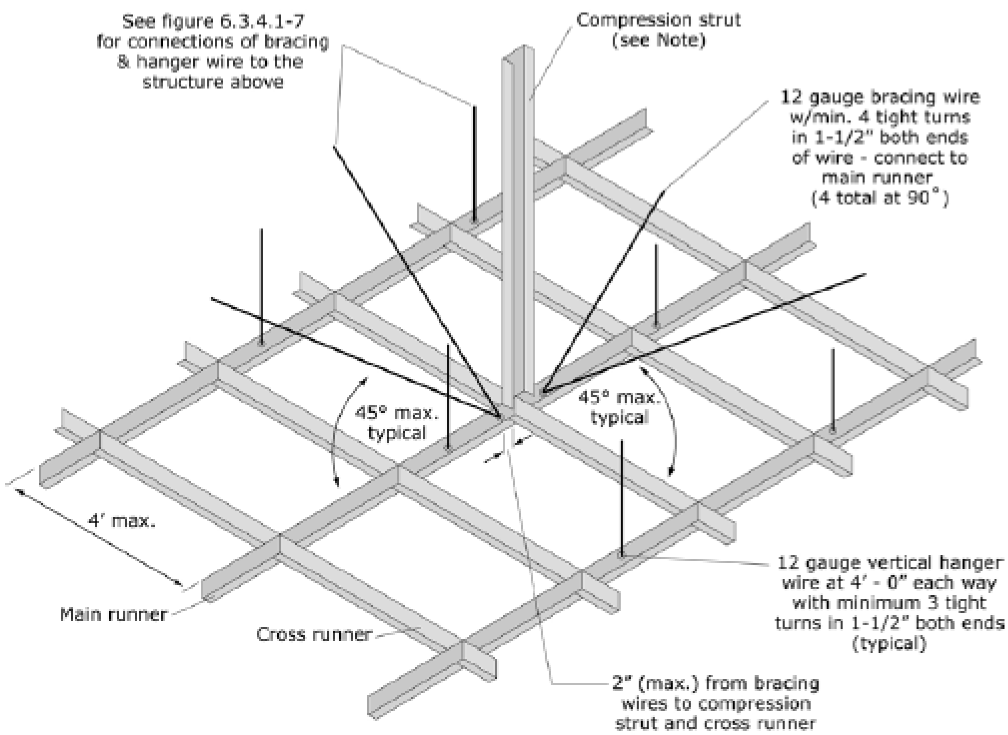


Figure G-8. Suspension System for Acoustic Lay-in Panel Ceilings – Edge Conditions.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



Note: Compression strut shall not replace hanger wire. Compression strut consists of a steel section attached to main runner with 2 - #12 sheet metal screws and to structure with 2 - #12 screws to wood or 1/4" min. expansion anchor to structure. Size of strut is dependent on distance between ceiling and structure (l/r ≤ 200). A 1" diameter conduit can be used for up to 6', a 1-5/8" X 1-1/4" metal stud can be used for up to 10'

Per DSA IR 25-5, ceiling areas less than 144 sq. ft, or fire rated ceilings less than 96 sq. ft., surrounded by walls braced to the structure above do not require lateral bracing assemblies when they are attached to two adjacent walls. (ASTM E580 does not require lateral bracing assemblies for ceilings less than 1000 sq. ft.; see text.)

Figure G-9. Suspension System for Acoustic Lay-in Panel Ceilings – General Bracing Assembly.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

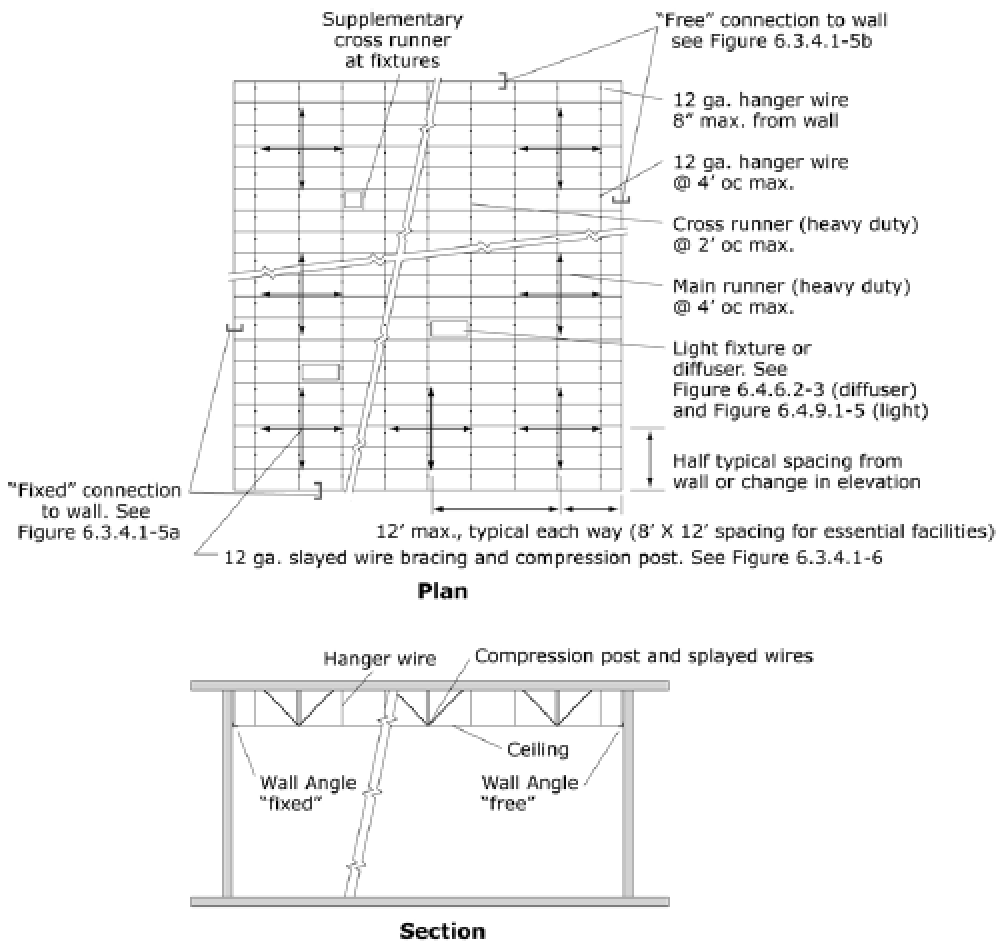


Figure G-10. Suspension System for Acoustic Lay-in Panel Ceilings – General Bracing Layout.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

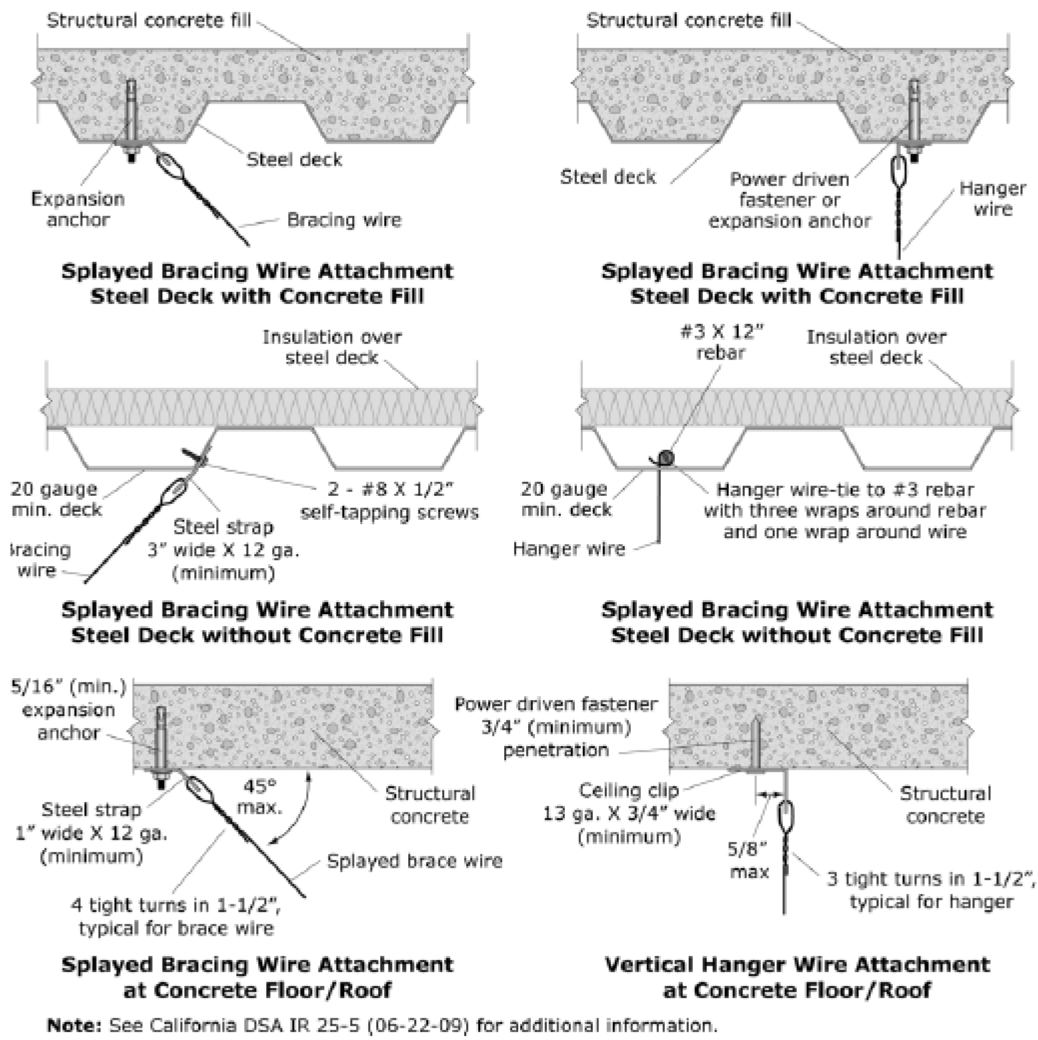
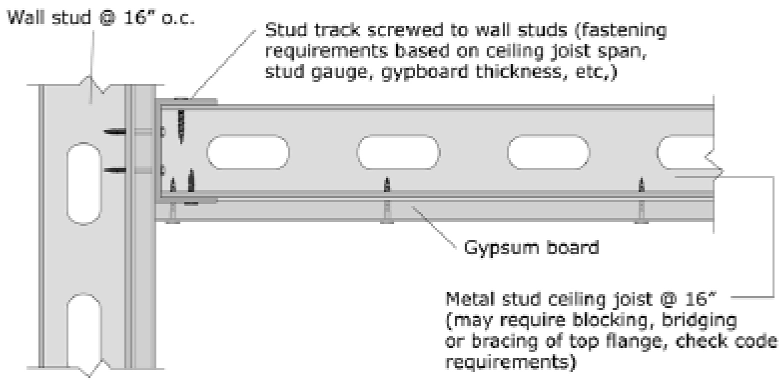
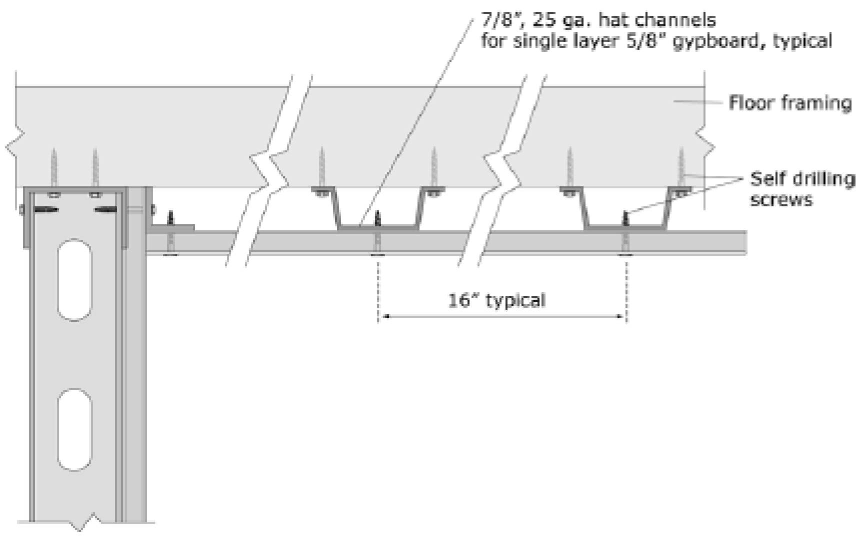


Figure G-11. Suspension System for Acoustic Lay-in Panel Ceilings – Overhead Attachment Details.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



a) Gypsum board attached directly to ceiling joists



b) Gypsum board attached directly to furring strips (hat channel or similar)

Note: Commonly used details shown; no special seismic details are required as long as furring and gypboard secured. Check for certified assemblies (UL listed, FM approved, etc.) if fire or sound rating required.

Figure G-12. Gypsum Board Ceiling Applied Directly to Structure.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

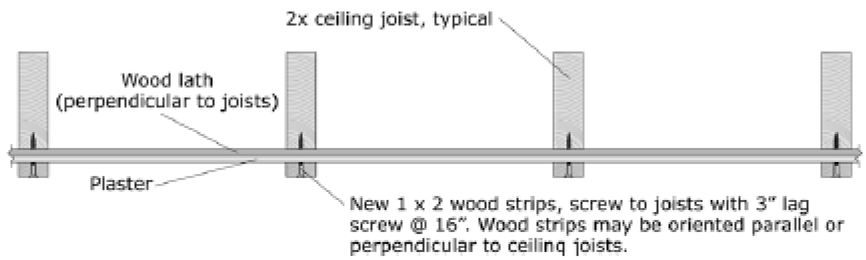


Figure G-13. Retrofit Detail for Existing Lath and Plaster.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

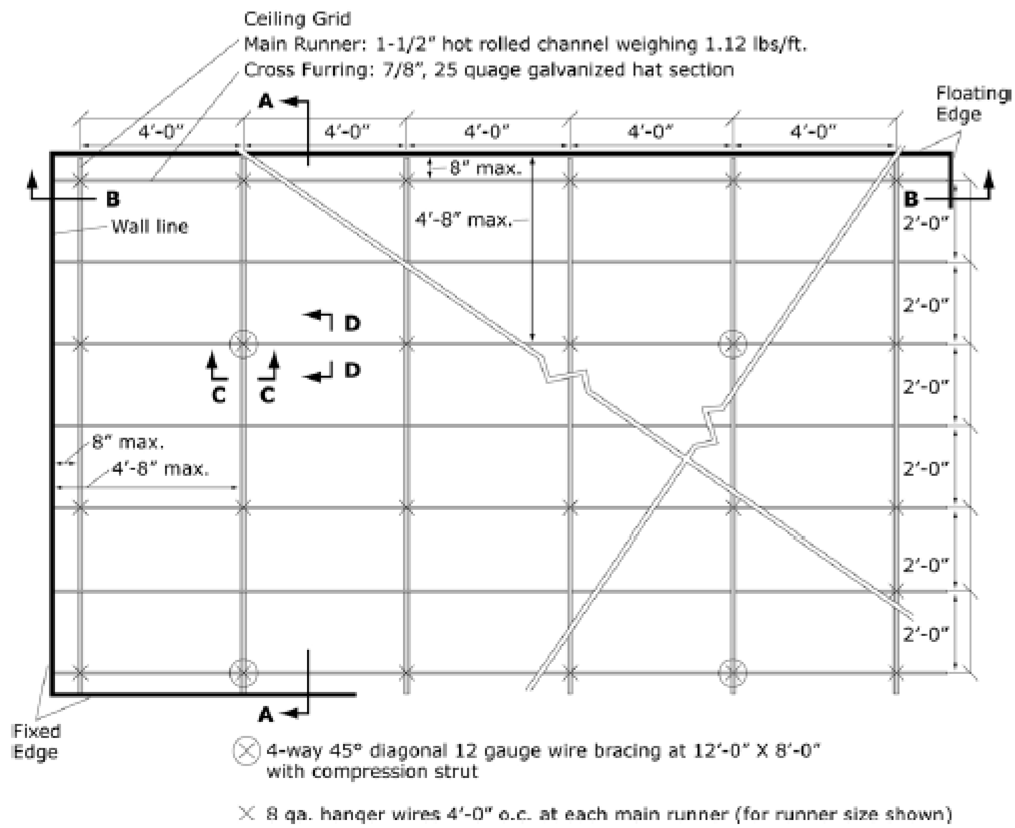
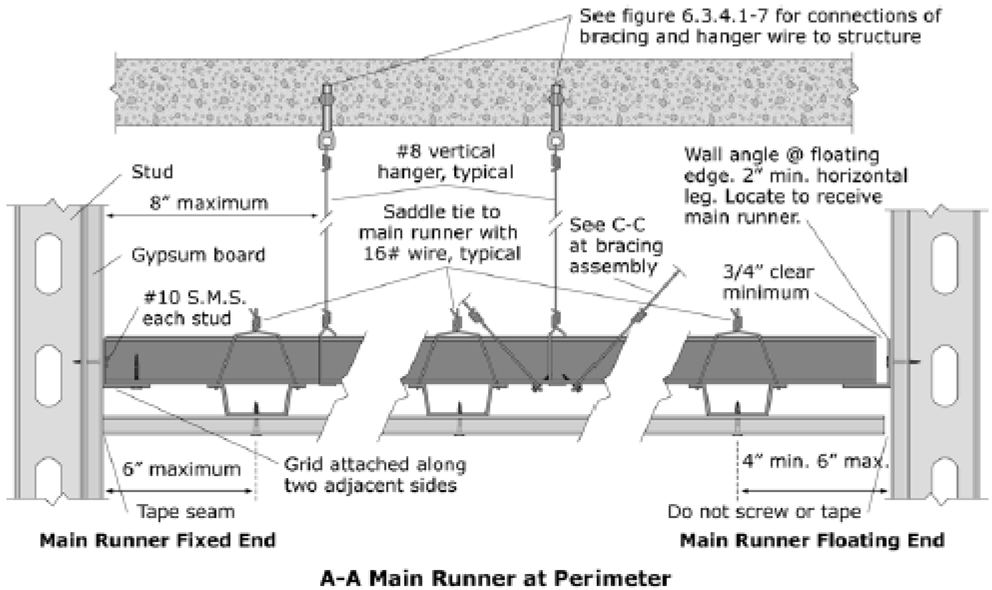


Figure G-14. Diagrammatic View of Suspended Heavy Ceiling Grid and Lateral Bracing.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



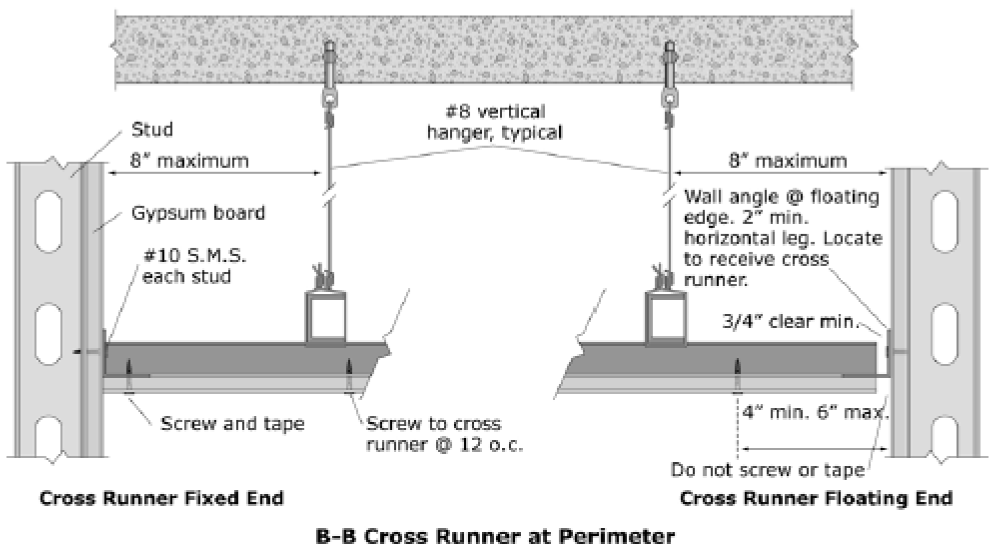


Figure G-15. Perimeter Details for Suspended Gypsum Board Ceiling.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

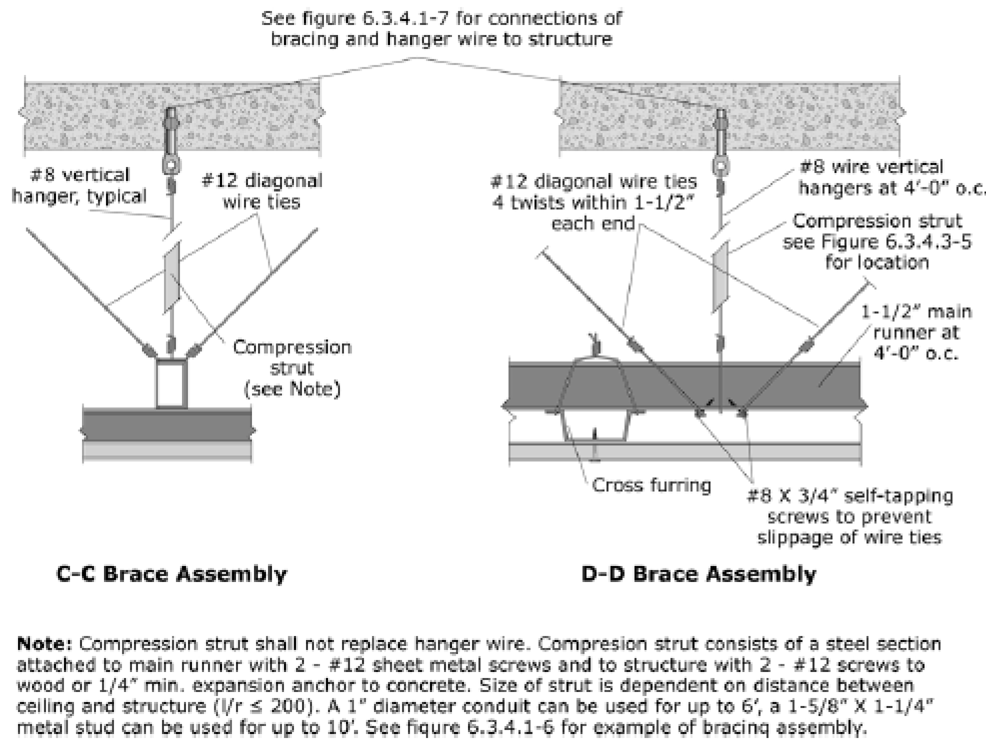


Figure G-16. Details for Lateral Bracing Assembly for Suspended Gypsum Board Ceiling.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Light Fixtures

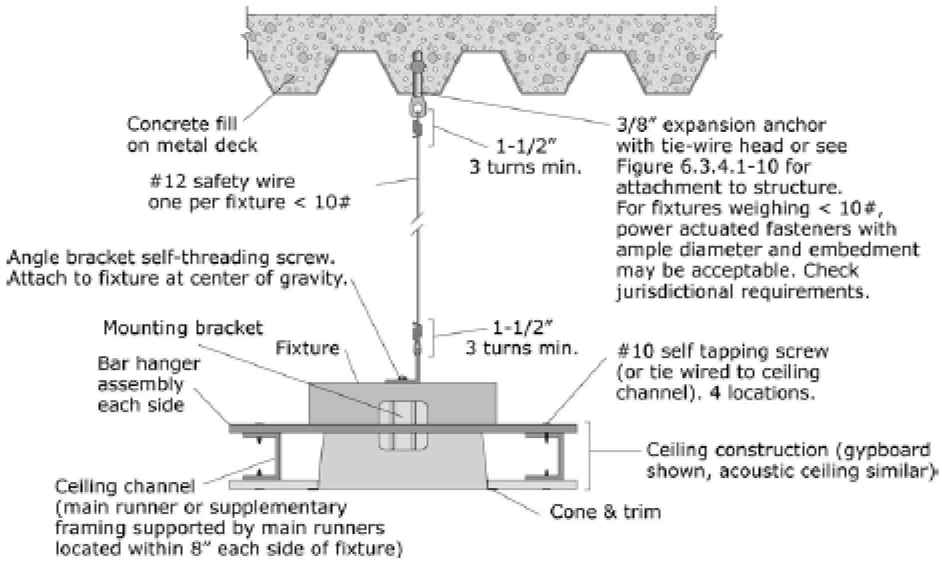


Figure G-17. Recessed Light Fixture in suspended Ceiling (Fixture Weight < 10 pounds).

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

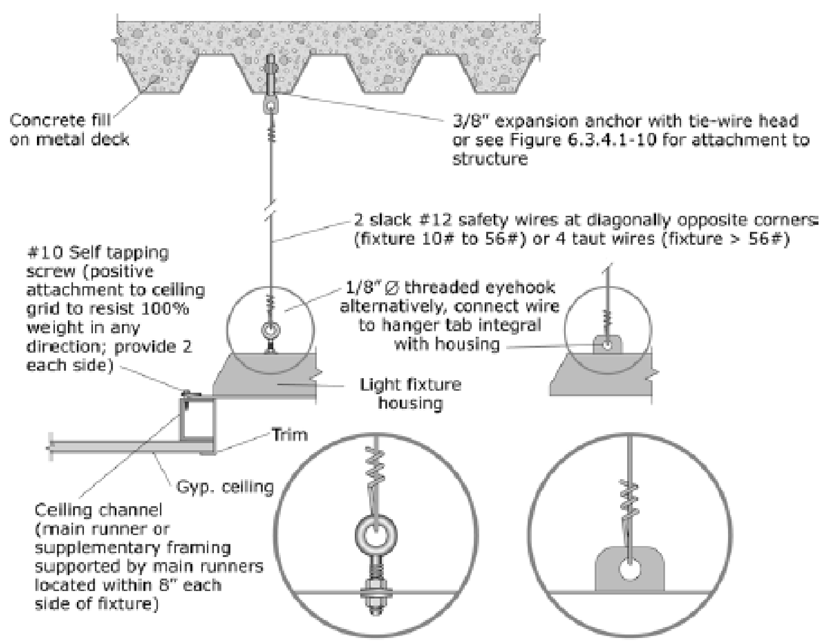


Figure G-18. Recessed Light Fixture in suspended Ceiling (Fixture Weight 10 to 56 pounds).

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Contents and Furnishings

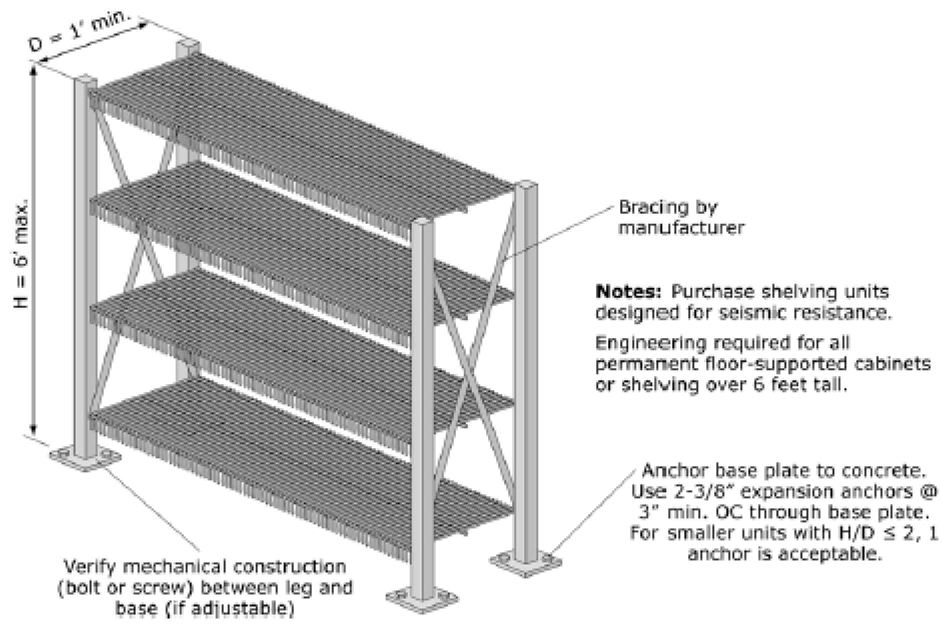
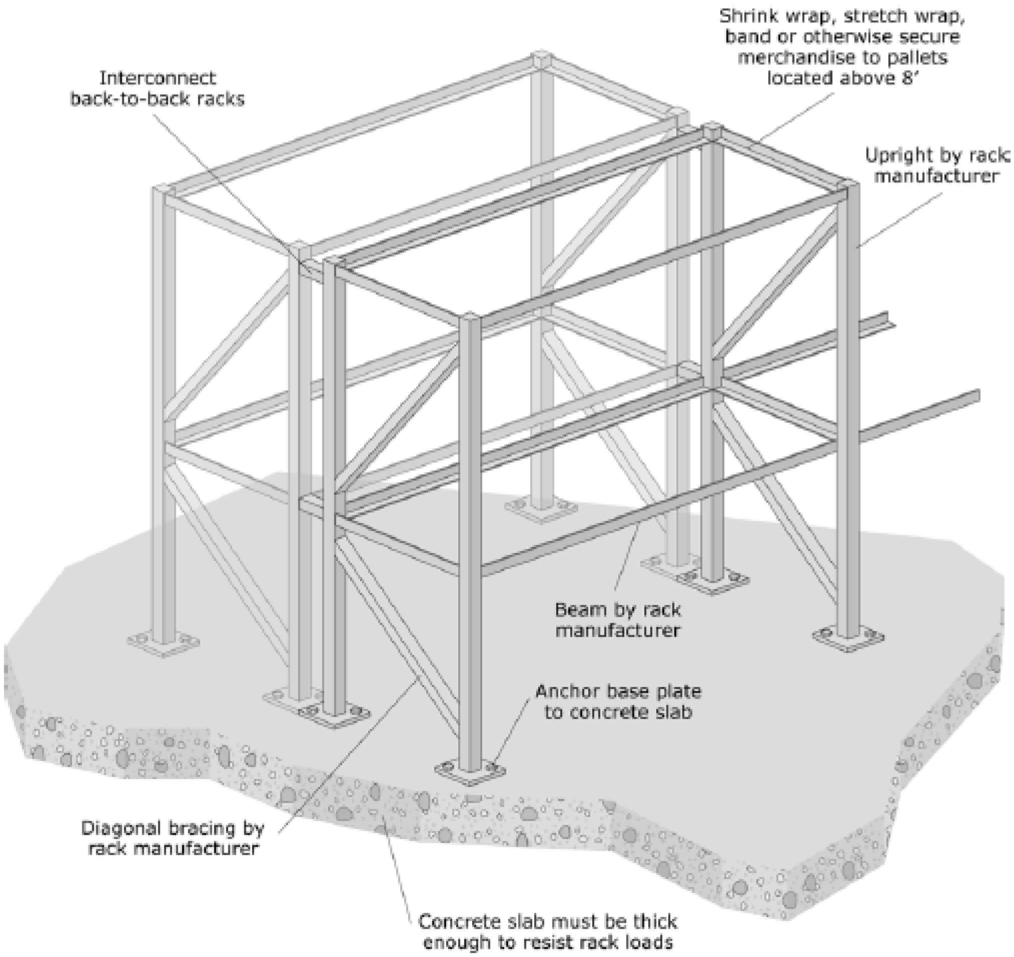


Figure G-19. Light Storage Racks.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



Note: Purchase storage racks designed for seismic resistance. Storage racks may be classified as either nonstructural elements or nonbuilding structures depending upon their size and support conditions. Check the applicable code to see which provisions apply.

Figure G-20. Industrial Storage Racks.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

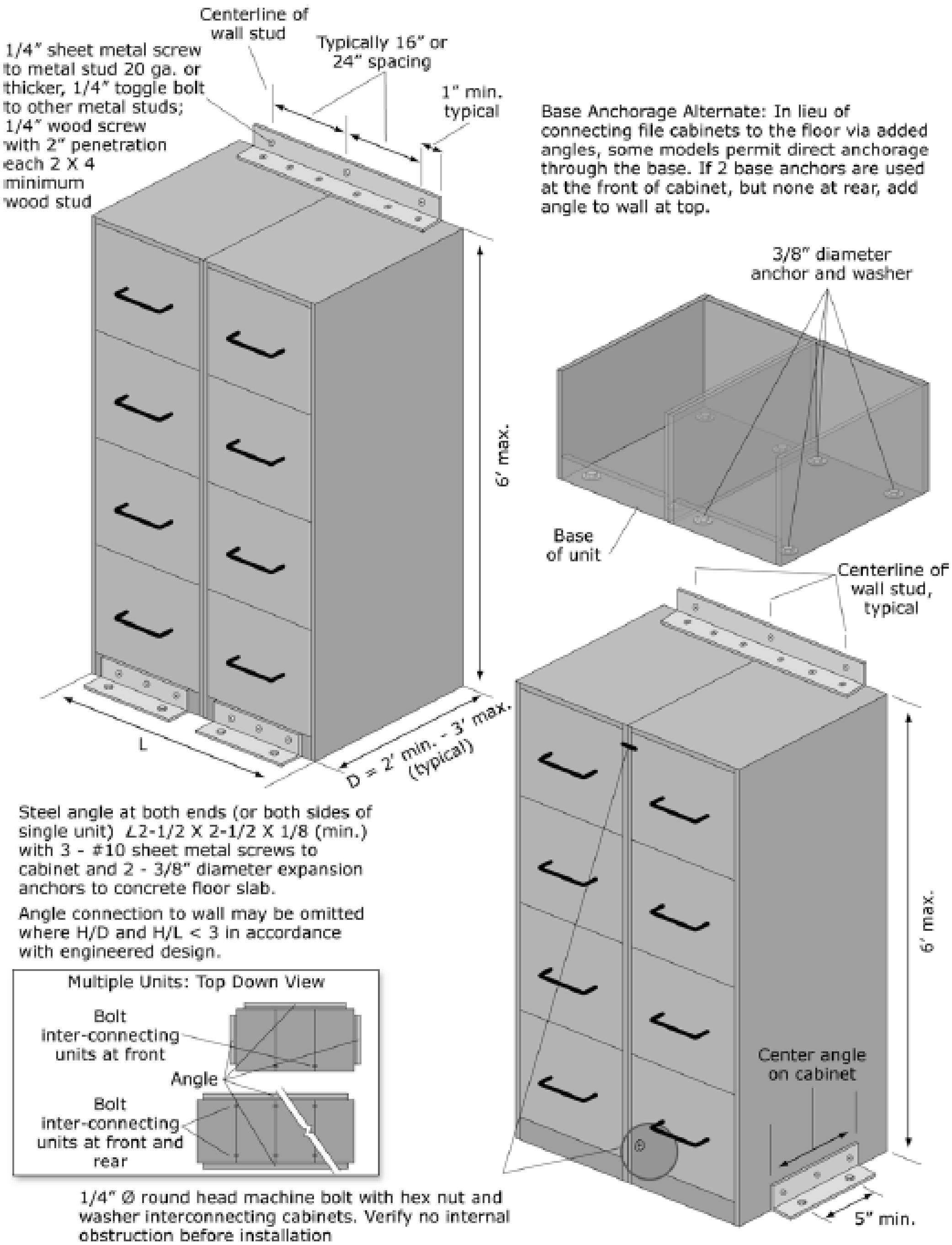


Figure G-21. Wall-mounted File Cabinets.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

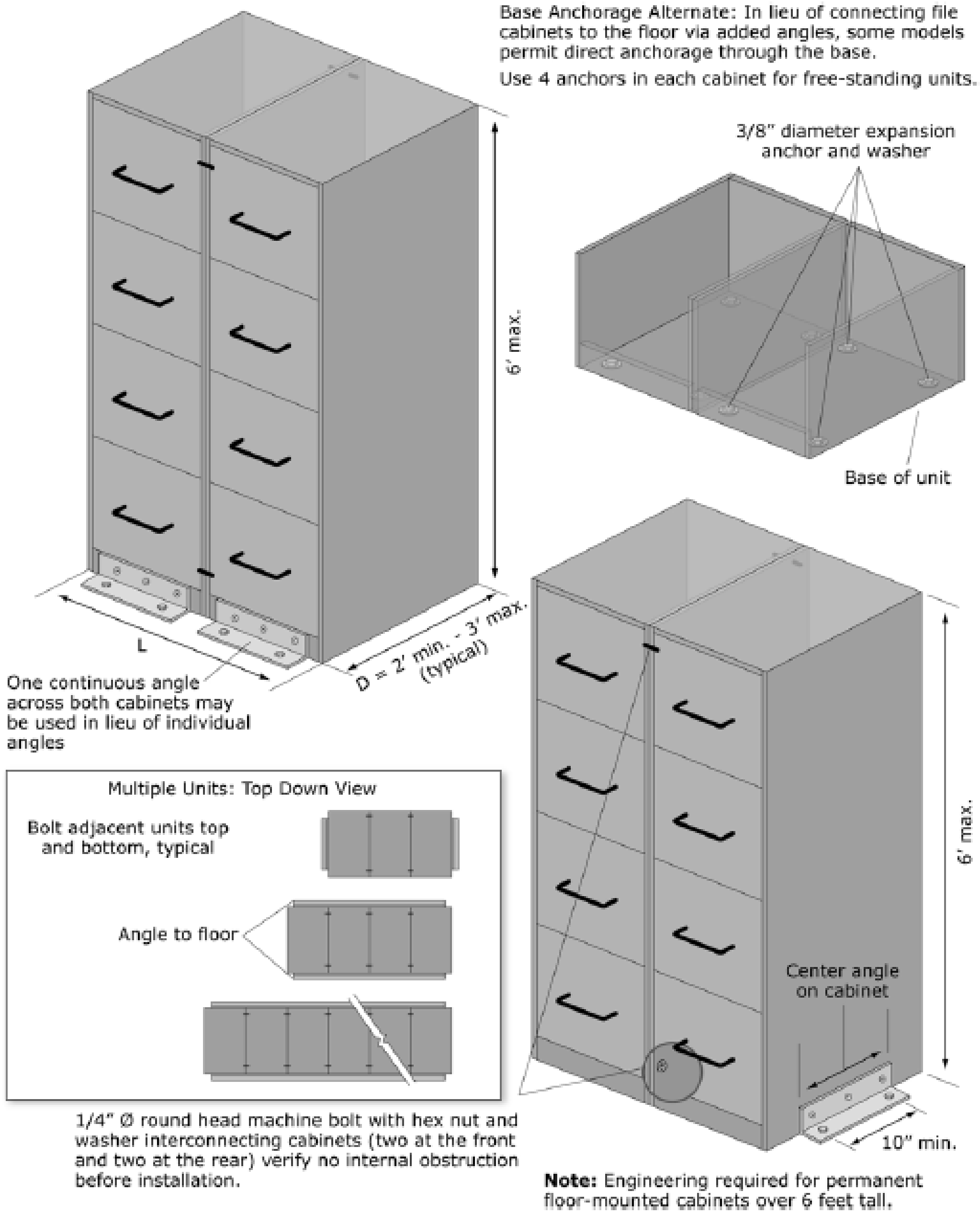


Figure G-22. Base Anchored File Cabinets.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

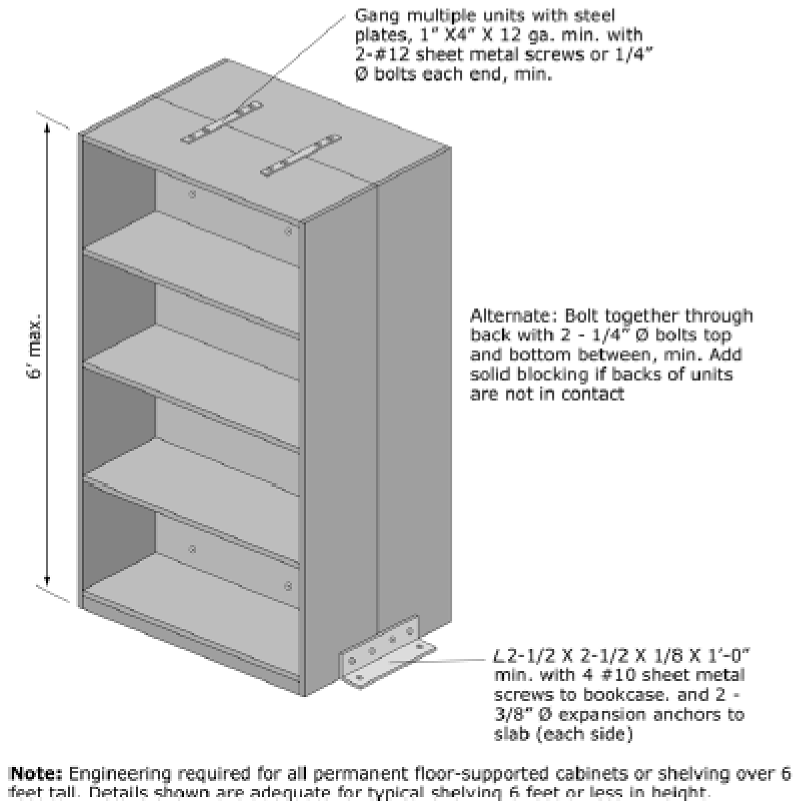


Figure G-23. Anchorage of Freestanding Book Cases Arranged Back to Back.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

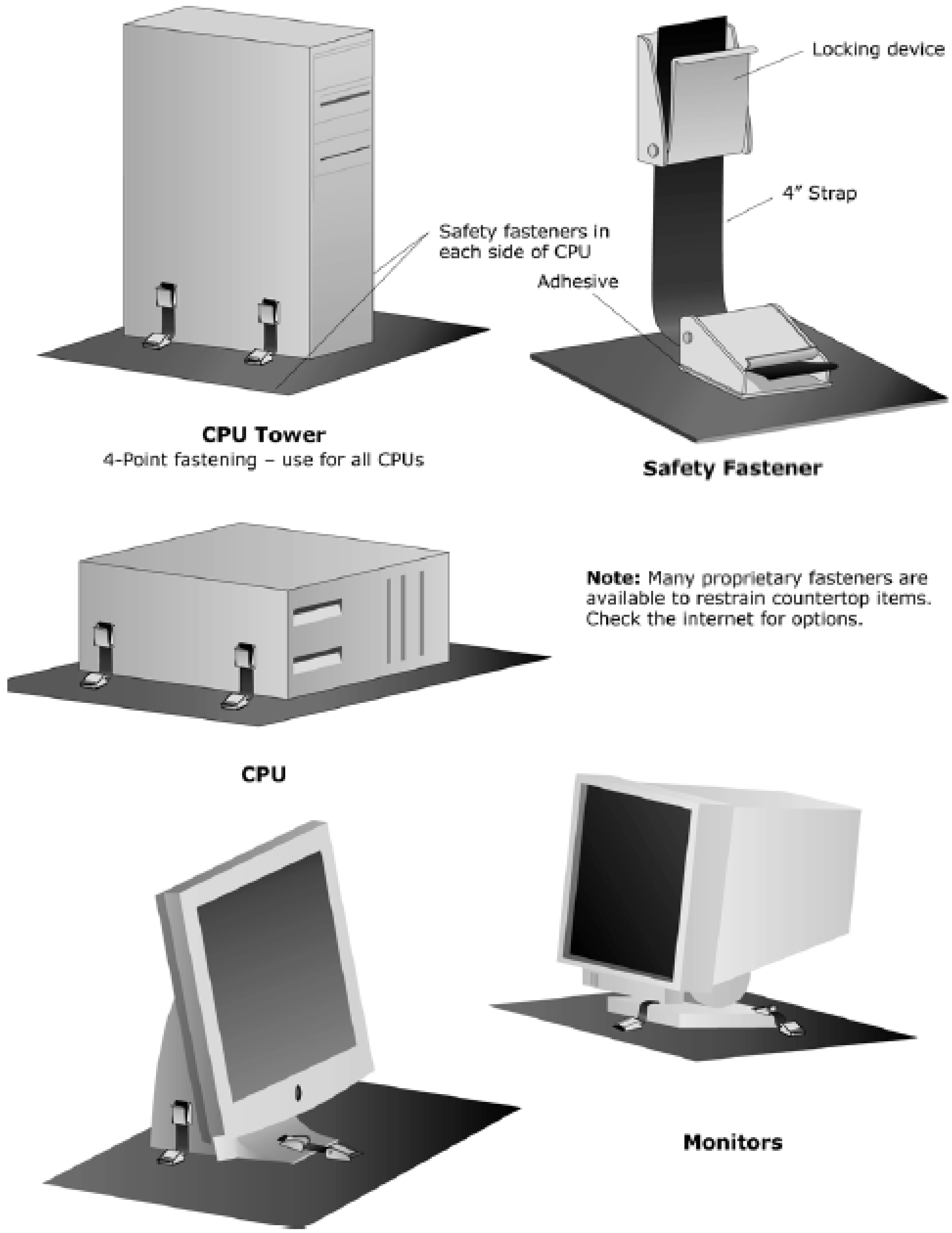
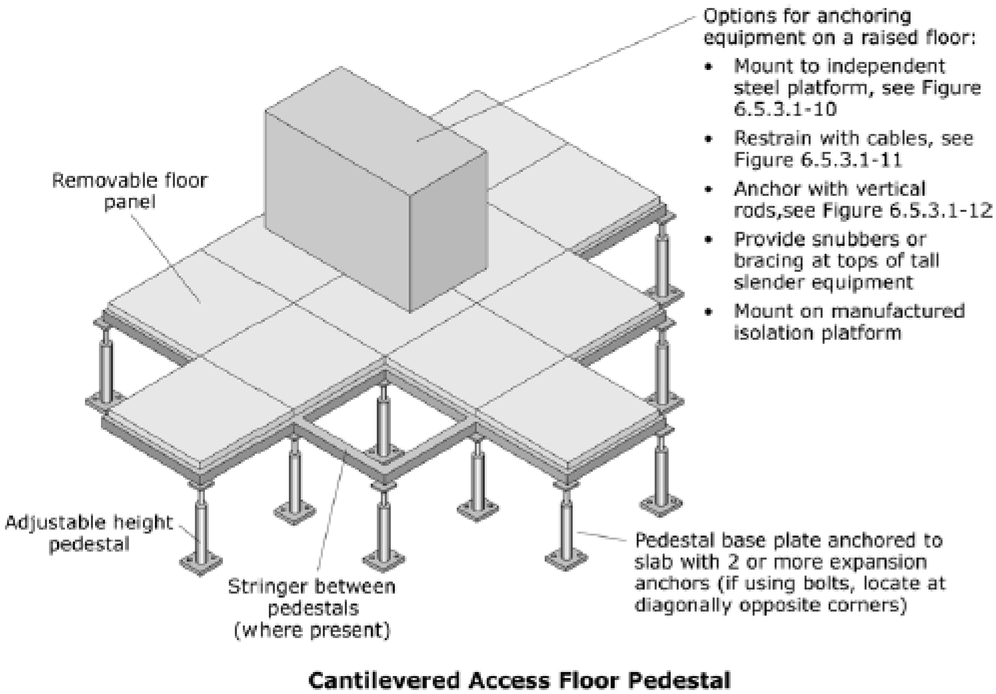
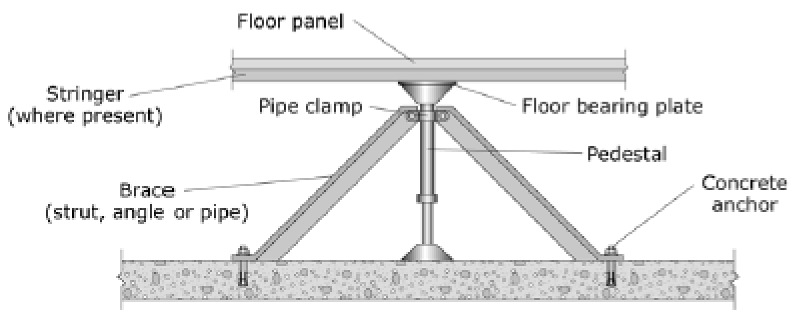


Figure G-24. Desktop Computers and Accessories.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)





Braced Access Floor Pedestal
(use for tall floors or where pedestals are not strong enough to resist seismic forces)

Note: For new floors in areas of high seismicity, purchase and install systems that meet the applicable code provisions for "special access floors."

Figure G-25. Equipment Mounted on Access Floor.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

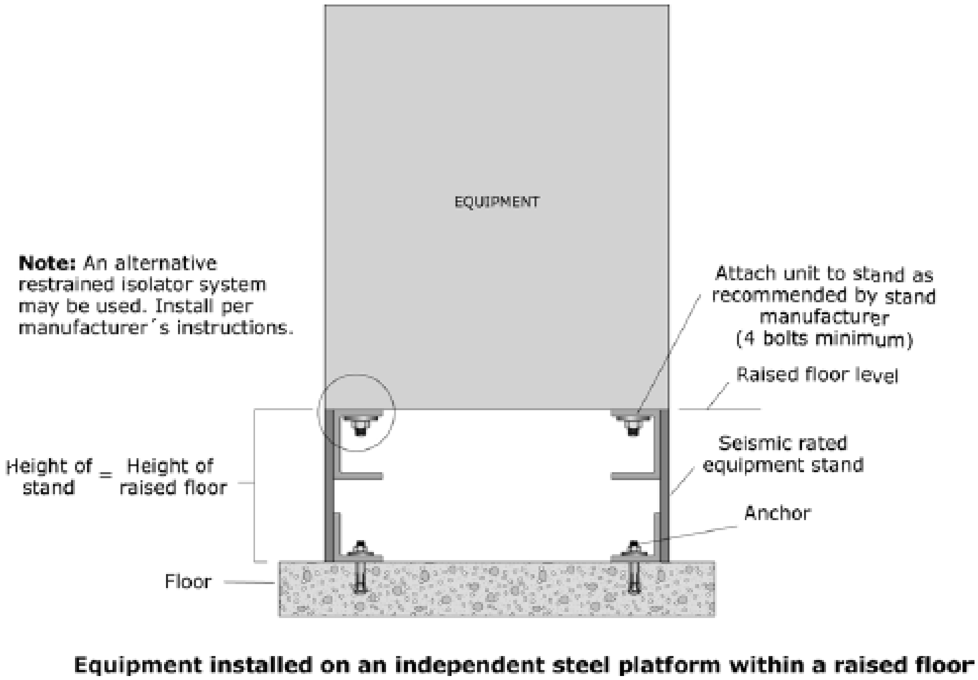


Figure G-26. Equipment Mounted on Access Floor – Independent Base.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

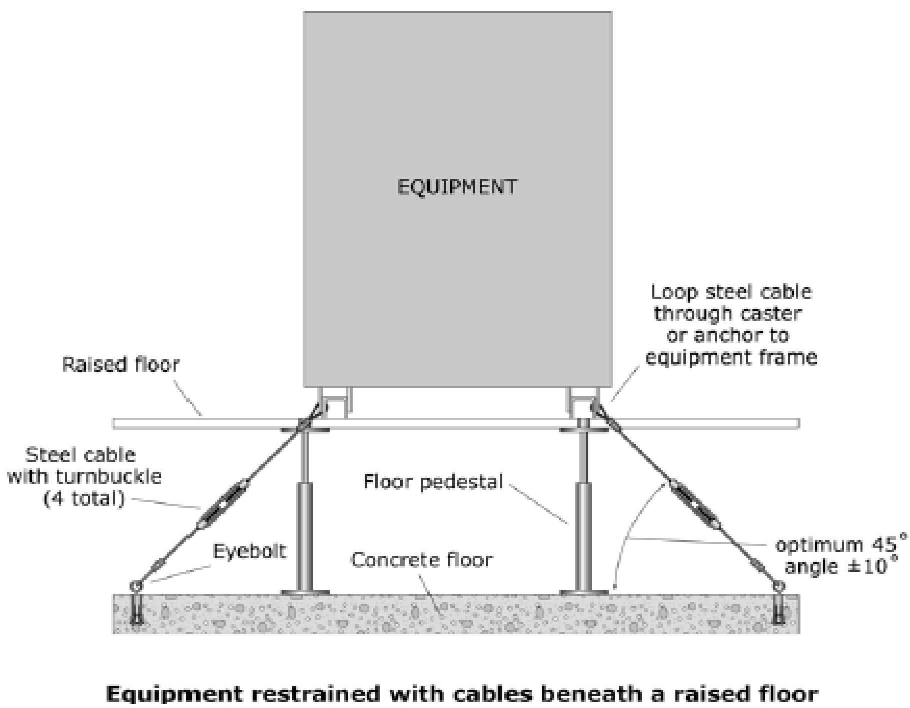
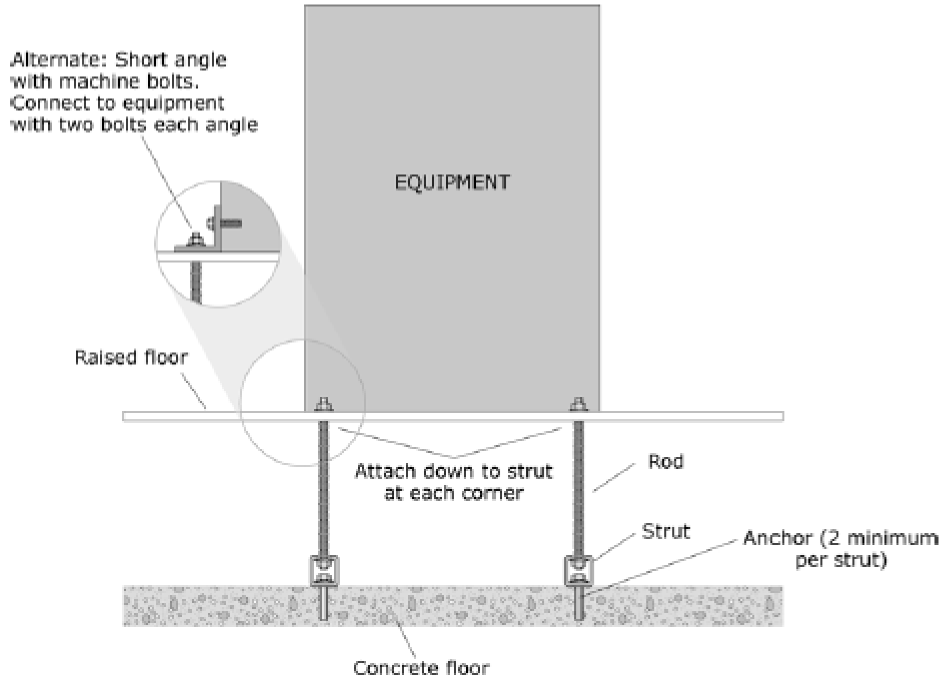


Figure G-27. Equipment Mounted on Access Floor – Cable Braced.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

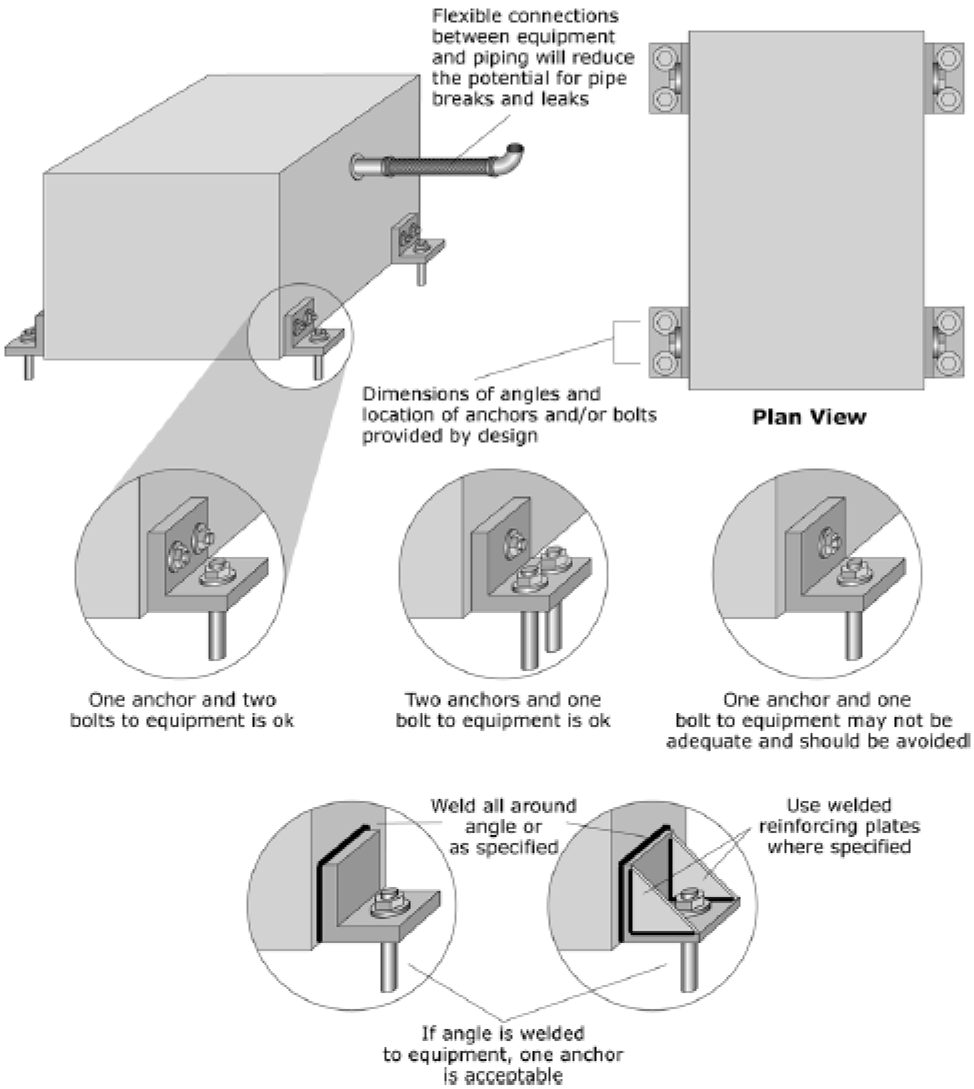


Equipment anchored with vertical rods beneath a raised floor

Figure G-28. Equipment Mounted on Access Floor – Tie-down Rods.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

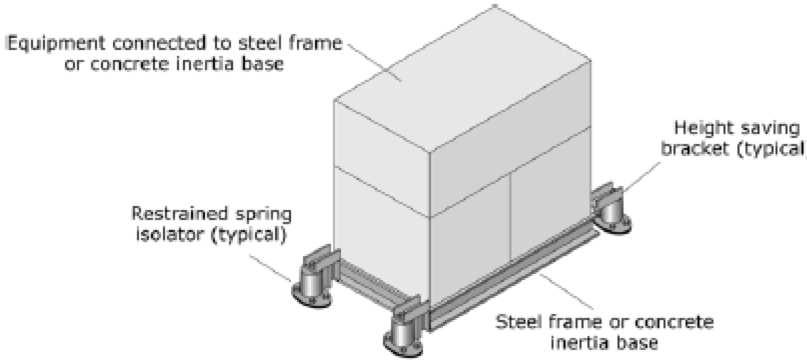
Mechanical and Electrical Equipment



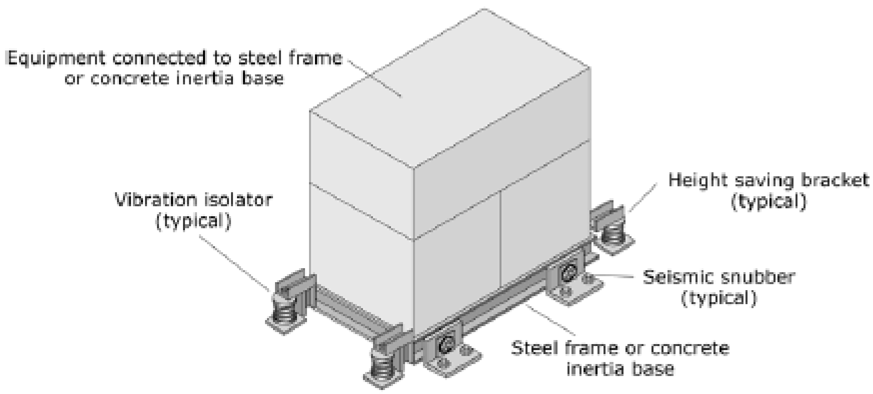
Note: Rigidly mounted equipment shall have flexible connections for the fuel lines and piping.

Figure G-29. Rigidly Floor-mounted Equipment with Added Angles.

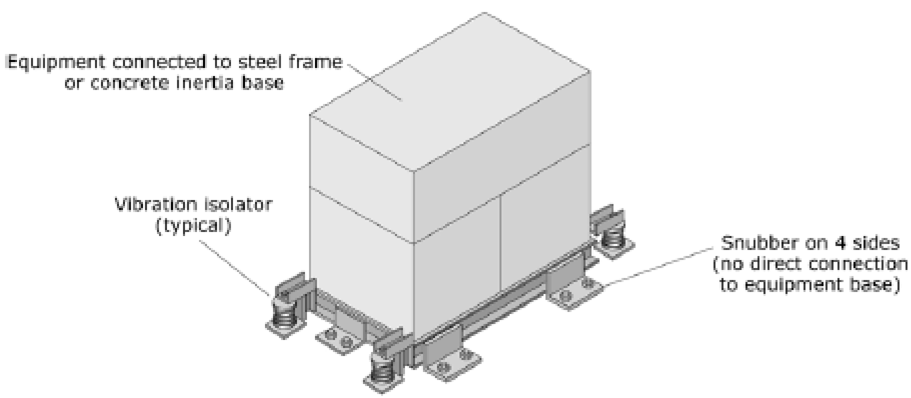
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



Supplemental base with restrained spring isolators



Supplemental base with open springs and all-directional snubbers



Supplemental base with open springs and one-directional snubbers

Figure G-30. HVAC Equipment with Vibration Isolation.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

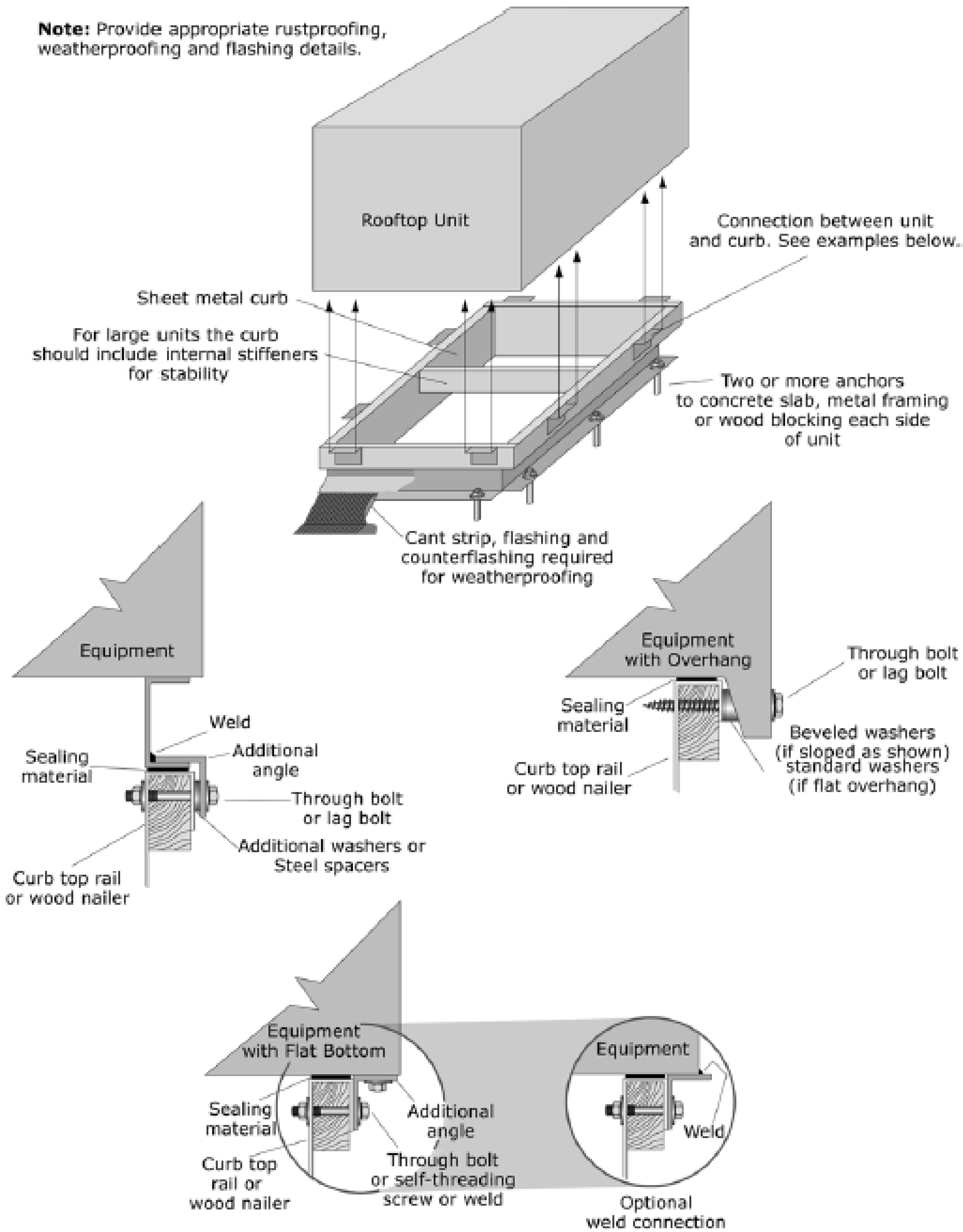


Figure G-31. Rooftop HVAC Equipment.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

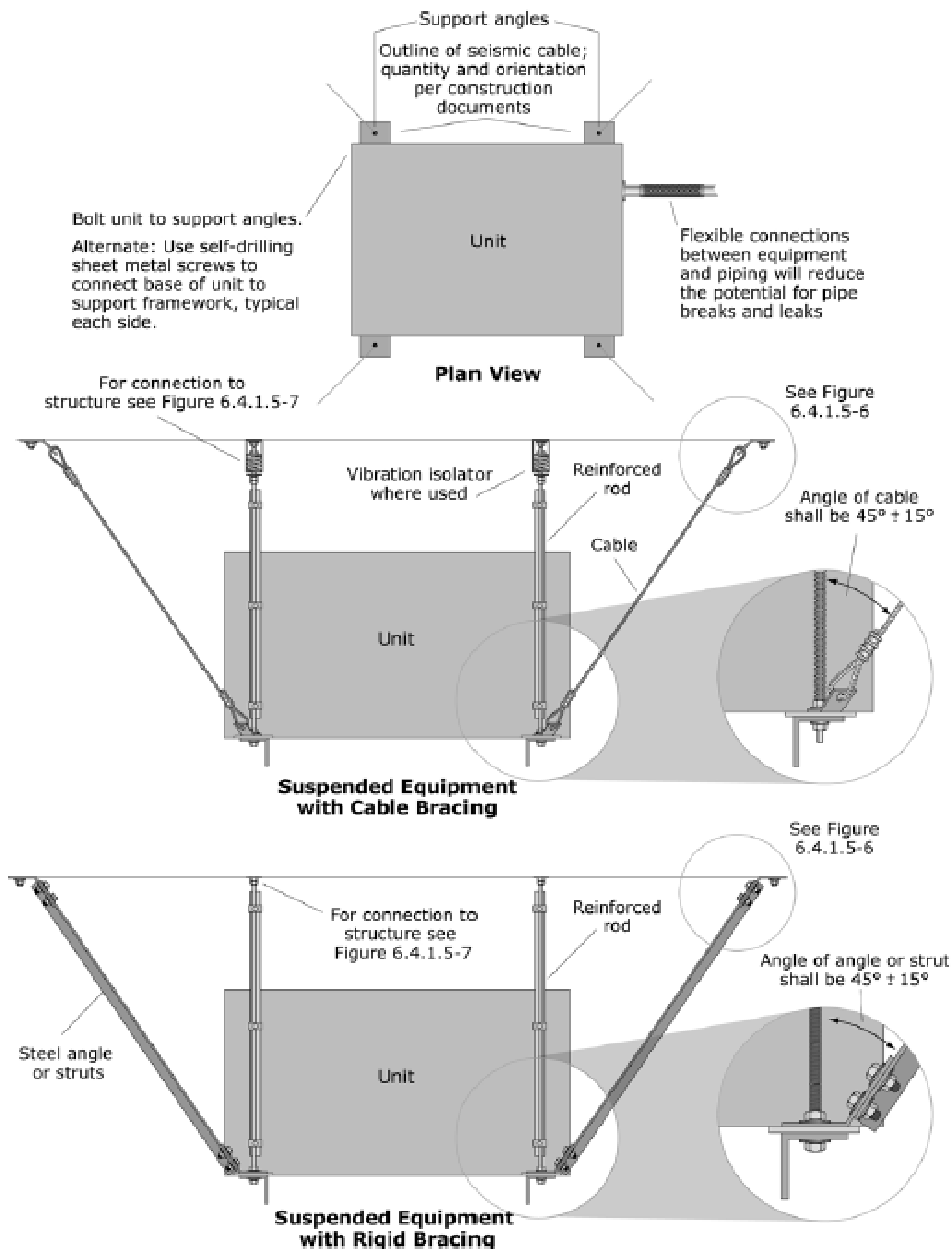


Figure G-32. Suspended Equipment.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

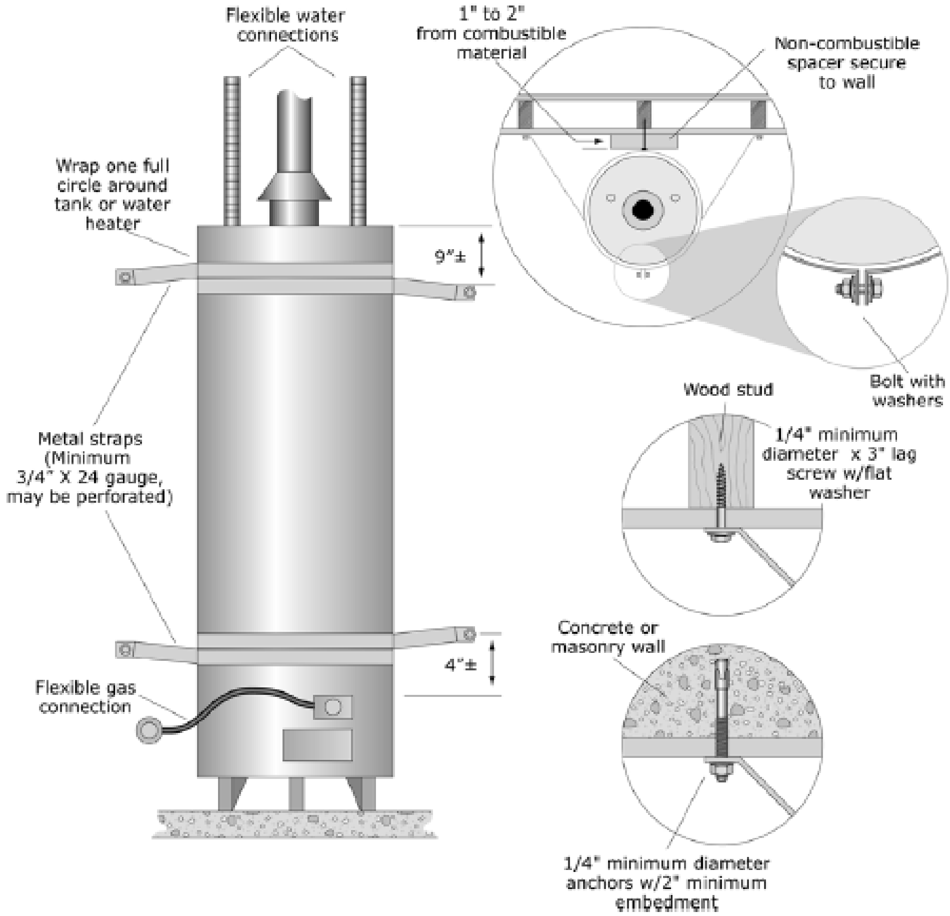


Figure G-33. Water Heater Strapping to Backing Wall.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

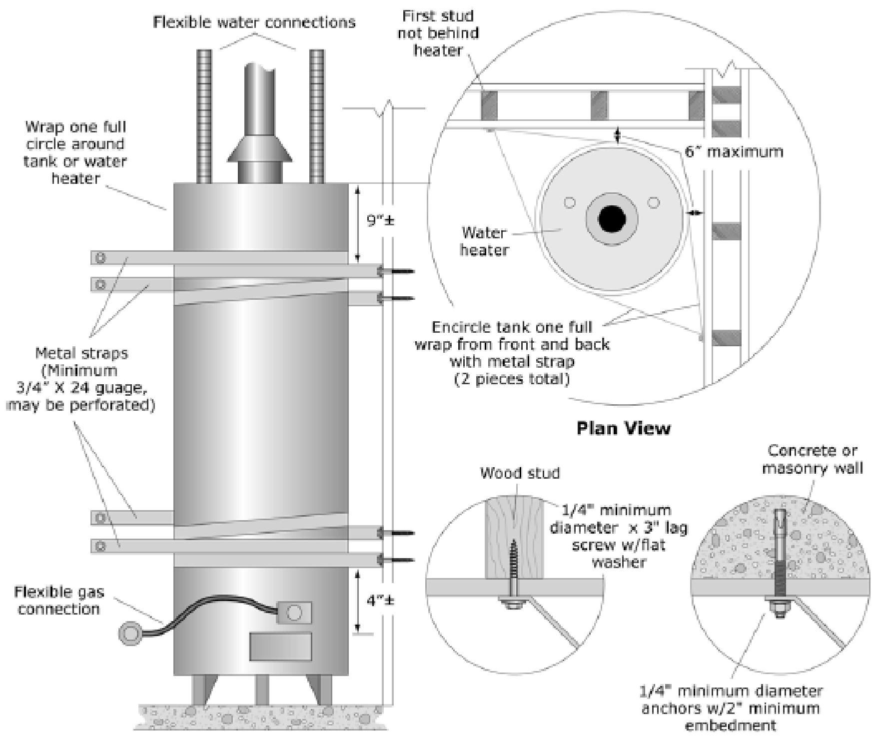


Figure G-34. Water Heater – Strapping at Corner Installation.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

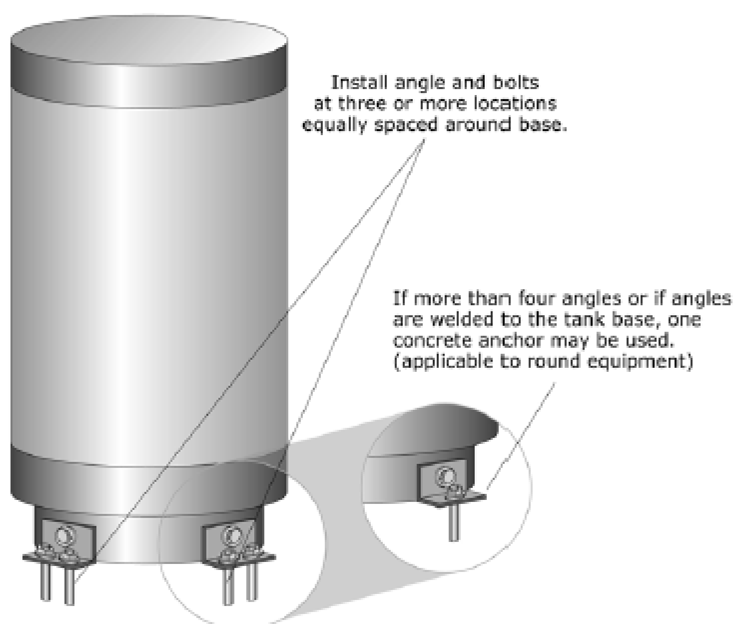


Figure G-35. Water Heater – Base Mounted.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

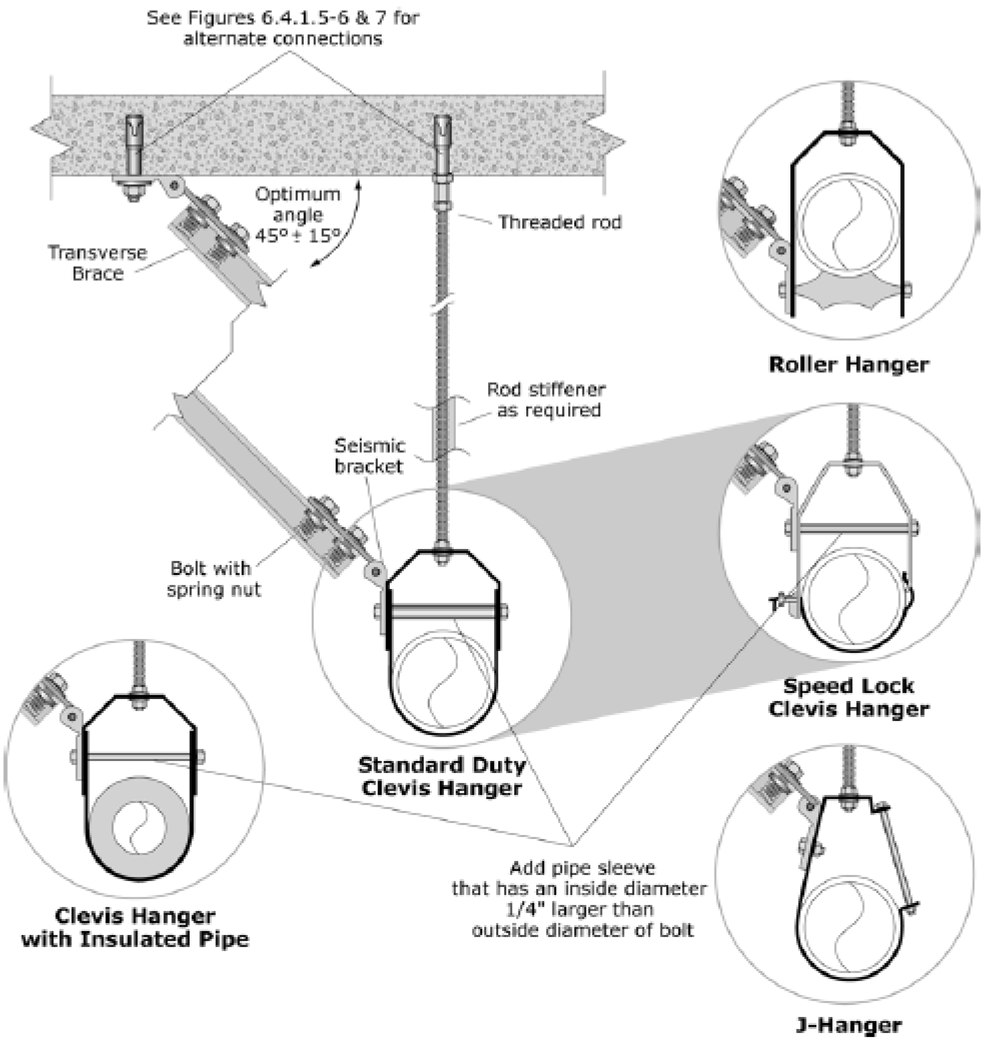


Figure G-36. Rigid Bracing – Single Pipe Transverse.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

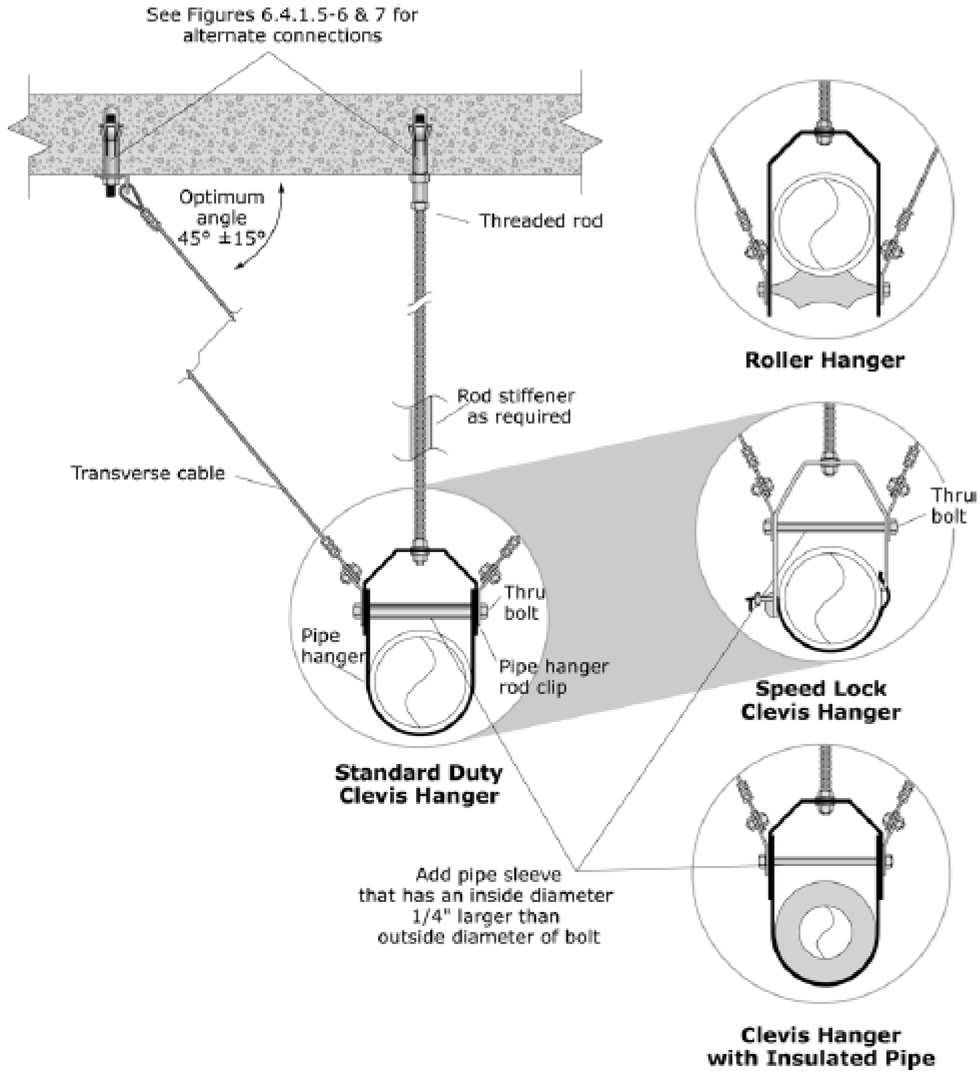


Figure G-37. Cable Bracing – Single Pipe Transverse.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Electrical and Communications

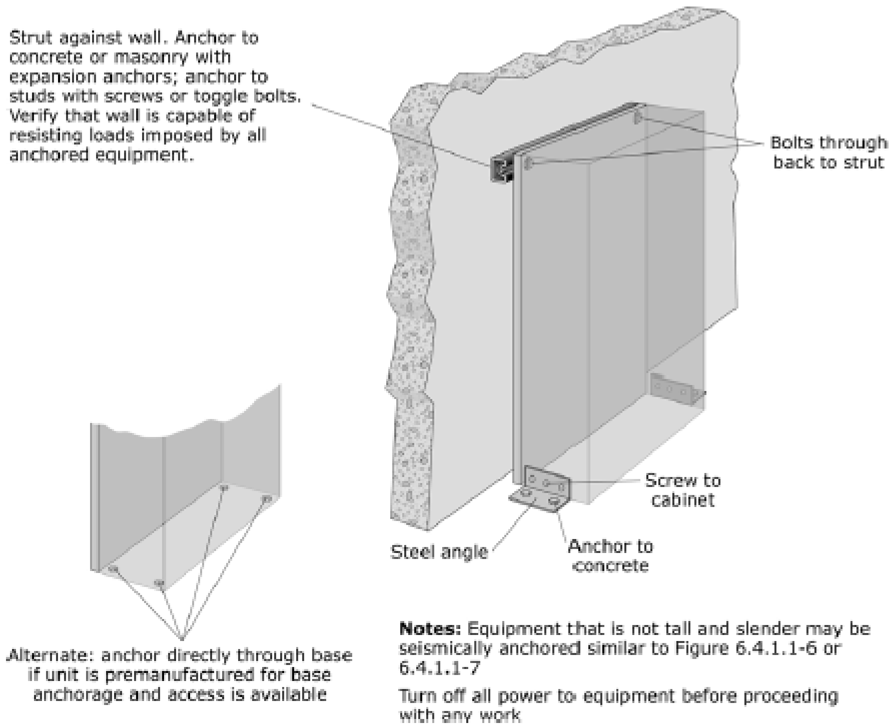


Figure G-38. Electrical Control Panels, Motor Controls Centers, or Switchgear.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

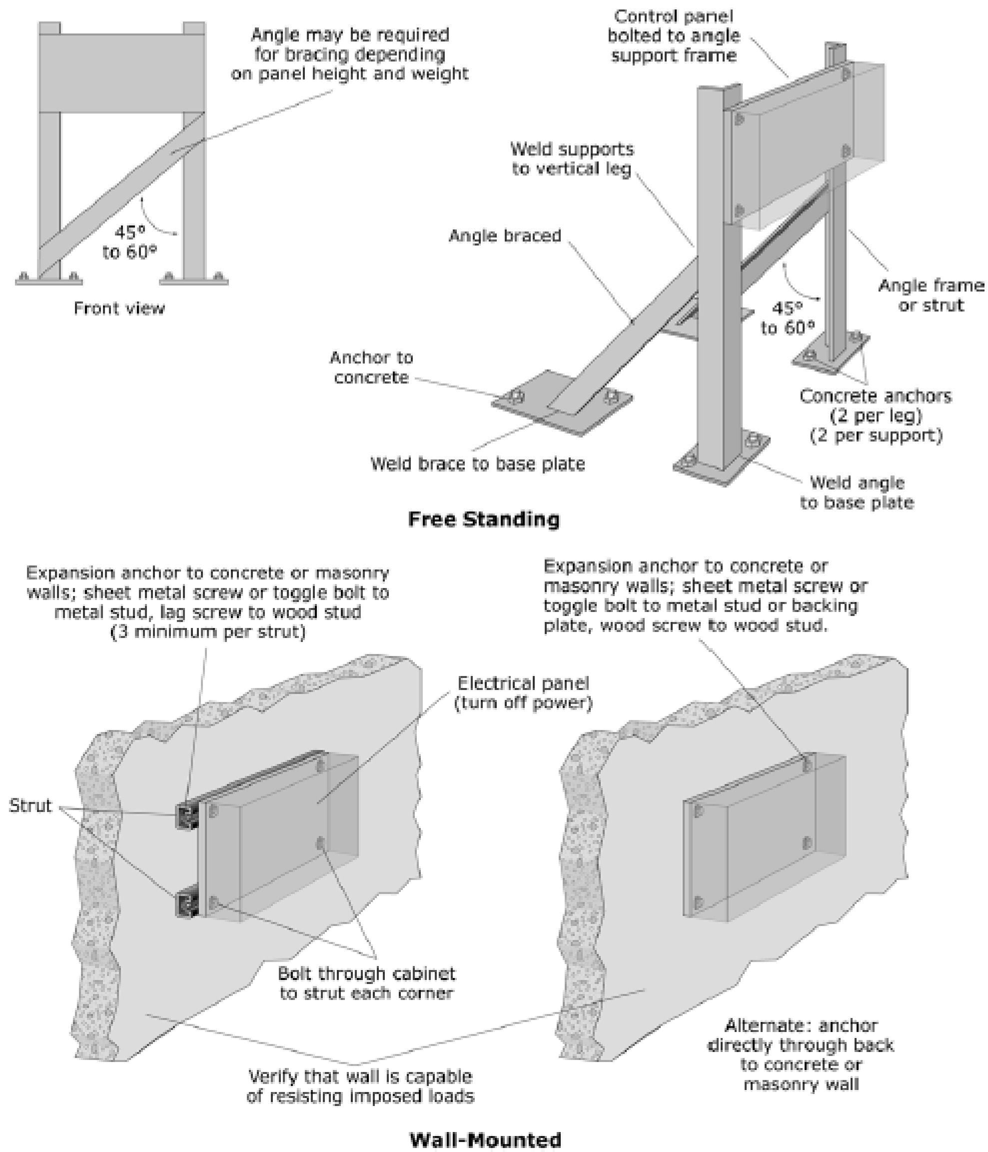


Figure G-39. Freestanding and Wall-mounted Electrical Control Panels, Motor Controls Centers, or Switchgear.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

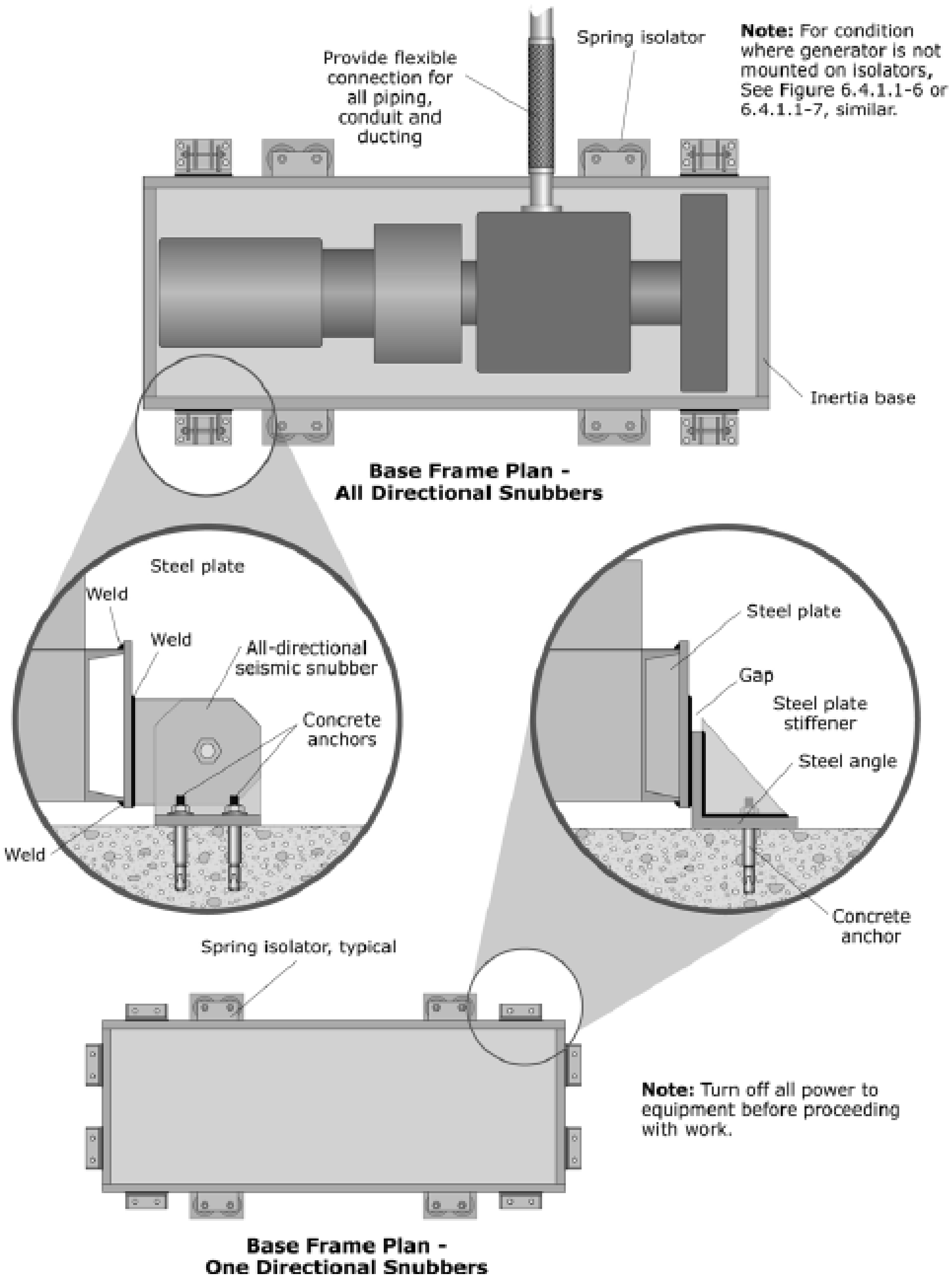


Figure G-40. Emergency Generator.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)